

TEACHERS' MANUAL FOR

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Science All About Us

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OUR WORLD OF SCIENCE

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TEACHERS' MANUAL FOR

Science All About Us

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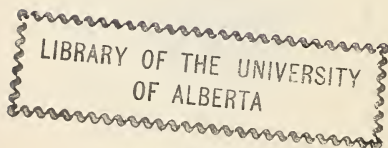
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Education 161
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TEACHERS' MANUAL

for Science All About Us

FOREWORD: OUR WORLD OF SCIENCE

"It is no longer possible for us to ignore science in the elementary school if we are to discharge our full responsibilities as teachers," a superintendent of schools said recently to his teacher. In these words he expressed the view of thousands of parents in the United States who have become convinced of the great power of science in this modern world.

Unquestionably teachers in the elementary schools wish to meet the growing demand for science. But many of them are hesitant about teaching science because they recognize a weakness in their own background. The basal books in the series **OUR WORLD OF SCIENCE** and the accompanying Manuals have been written to meet the needs of classroom teachers, whether they have had previous training in science or not. The program of science presented in this series is one in which teachers can learn science with their pupils.

Reasons for Teaching Science

A moment's reflection is sufficient to indicate that there is no part of the elementary-school curriculum that has more important contributions to make to the present and future welfare of the nation and of the world than has science. In the following paragraphs are discussed briefly a few of these contributions.

Science makes it possible to abolish poverty. Geologists have learned a great deal recently about how to explore the earth for basic material resources. In cases where raw materials for some substances are scarce, chemists have learned ways of making synthetics which will serve all the purposes required of the original substances. This is illustrated in the manufacture of synthetic tires and quinine, for example. Chemists strive to make new substances from raw materials that are found in abundance, such

as clay, farm produce, and coal tar, thus providing new substances at a very low cost. In this way industry is promoted, more people are given employment, and the new materials are made available to increasing numbers of people. Will the children in our classrooms be prepared to utilize wisely the great material resources of the earth?

Science makes it possible for us to eliminate backbreaking toil. A few years ago most of the work of the world was done with muscular energy. Today we have learned to harness vast stores of energy to machines that may be operated by the pressing of a button. These laborsaving devices can be used in our homes, in factories, and on the farm. Tasks which took hours or days to accomplish can now be completed in a simple operation, and thus more hours are provided for recreation. Will our children be equipped to make intelligent adjustment to the vast supplies of energy and new laborsaving inventions which are daily being made available?

Science makes it increasingly possible to improve the health and safety of the peoples of the world. One of the tasks of the children in our classrooms will be to see that the discoveries of the scientist make a life of good health and freedom from accident available to all.

Science makes it possible for hunger to be abolished. Many authorities contend that an ample supply of food can be raised for all the people of the world by using the improved methods of agriculture which have been discovered in recent years. There is, however, a grave danger that humanity will face increasing periods of famine if it does not soon learn to save its great soil resources. Will our children have the vision to plan for an ample world food supply, or will they through ignorance cause new periods of famine?

Everywhere we turn we see science offering to humanity a higher standard of living in the form of improved food supply, recreation, transportation, communication, and health for all. This improvement, secured on a world-wide basis, would eliminate the chief causes of rivalry between nations and would help to promote permanent world peace.

The United States, as a result of recent events, has assumed a unique responsibility for world leadership. American children must be encouraged to have high ideals of service to humanity, and they must know how to put their ideals into operation on a democratic basis. They must be made to realize the responsibilities and opportunities that are theirs because they are Americans. They must discover while they are young the importance of science and must learn how it can be used to promote world welfare.

The record of the past indicates many fatal errors. Depressions, wars, destruction of valuable soils, pollution of streams and waterways, wastage of mineral resources, introduction of crop pests, have left their mark. With them have come needless poverty and ill health. The elementary school today is responsible for the development of a generation that will be wiser than past generations. Children must learn to realize the power that man has secured through science for the development of a civilization superior to their own.

The task, then, of the elementary teacher in teaching science is clear. Failure on her part to open up the avenues of science to the natural drives of children may result in citizens of tomorrow who are poorly prepared for the adjustments and responsibilities of the atomic age.

The Use of Books in the Teaching of Science

As much as possible the teacher should work with the children while they work, read with them while they read, discuss matters when they discuss them. In other words, the teacher should be a member of the group, learning with the children in a natural situation instead of watching their activities as a bystander or outsider. In all this work the basal book in science can lead to dynamic motivation and vitality of instruction.

The Development of an Informal Working Situation. An informal working situation in teaching science brings good results. It provides an opportunity for children to express their own ideas and to develop lines of interest.

This need not be interpreted, however, as a loose and undisciplined procedure. Science in itself has its discipline, which grows out of the scientific method and attitudes, and the teacher¹ should be keenly aware of the relation of method and attitudes to desirable social behavior in children. If this awareness is applied in science teaching, the teachers of a school should discover, in the work from the first grade through the eighth, a marked improvement in the ability of children to work together on problems.

In the teaching of science both teacher and children should feel relaxed. Much of the austerity found in American classrooms grows out of pressure and haste, which are not in keeping with the rhythm and tempo of child life. If the teacher will remember that the very nature of science calls for discovery and open-mindedness, she will lose the fear of admitting an error in her own thinking. She need have no reluctance in stating frankly that she is learning with her pupils and that there are many things she does not know. The true scientist is learning when he is making discoveries.

Reading in Science Teaching. Reading in the science book should lead to other types of activities, such as discussion, performing an experiment, and planning a science excursion. These activities in turn will cause the children and teacher to go back to the basal book or to supplementary material for information and for new interests and subjects. Many teachers find oral reading useful in science teaching.

As much time as is needed should be taken to clear up each thought. The teacher should allow the child to work important ideas found in the basal books into his thinking through the use of such basic drives as curiosity, imagination, and manipulation. The use of children's natural drives need not place the teacher in an embarrassing position, since in an informal teaching situation children can help one another.

It should be noted that this kind of work does not call for rapid reading. In fact, it may mean slow reading, with much

¹Gerald S. Craig, *Science for the Elementary-School Teacher*, pp. 13-19, 30-36. Ginn and Company, Boston, 1940.

consideration of a single sentence, paragraph, or page, and the relating of content to the children's observations and experiences. The way in which children should use books in science is quite different from the way in which they read a book of fiction, such as a storybook. In science one is seeking truth, and truth is not secured through superficial reading.

Discussion and the Use of Basal Books. Discussion in science can grow out of the use of books. A child or the teacher may have a question about something that has been read. There may be an incident which a child or the teacher wants to add to illustrate a point. Someone may attempt to explain a statement or to add more content to make a point clear. Another may propose the making of a sketch or other art work to illustrate a point. In all this, books will serve to stimulate discussion. Basal science books will be useful also in checking the accuracy of the discussion.

A discussion may last only a few minutes, or it may profitably continue for some time. Teachers should strive toward the improvement of discussion; with younger children discussion is fragmentary and impulsive; with older children it may be characterized by high qualities of critical-mindedness and intelligent planning. Children can secure no small training in learning to discern the difference between reliable and unreliable information as a result of science education in the elementary school.

In teaching science we are concerned primarily with how to find the truth. The process of finding the truth is one that the teacher must share with the children. An authoritative book in the hands of a child serves to assist both him and the teacher in discovering the truth. The teacher should ask from time to time such questions as these: "How can we find out? Are you sure? How can we get the answer? Can you prove it? Why do you say that? How much of what you said is true? What does it mean to you?" It is to be noted that the teacher's primary task is not to answer questions but to help the children find the solution.

Experiments and the Use of Basal Books. Children in the elementary school should become aware of the meaning of experi-

mentation. OUR WORLD OF SCIENCE is filled with suggestions of experiments which can safely be performed by children with equipment that can be obtained in any community. An experiment should be seen as something more than a funny trick or magic. Attention should be focused on what the experiment is to prove. Discussion forms an important part of experimentation in science. It is frequently wise to repeat experiments. Finally, the conclusions developed through the use of experiments should be checked with authoritative books whenever possible.

Field Excursions and the Use of Basal Books. At all times the content of the book should be closely related to what is going on in the community. One means is the field excursion. A field excursion may be short or long, depending on its purpose and the locality to be visited. Sometimes a trip may be made to the heating plant in the school basement, to the fuse box, to a fire extinguisher in a near-by hall, to some vantage point to observe the change of seasons, or to a suitable place to observe the clouds and weather changes. It frequently is advisable to make a trip again after an interval in order to note changes. This is particularly true in studying seasonal changes or the procession of weather changes.

Vacant lots, quarries, gravel pits, road cuts, plowed fields, meadows, woods, orchards, barnyards, are particularly good places for observation. The study of construction work, such as that of new buildings or new highways, power lines or telephone lines, provides opportunity for observation for children at all levels. Then, too, the work of the custodian or janitor of a school building has its scientific aspects, which give children opportunity for useful observation. How the various services, such as water, gas, telephone, electric power, enter a building is usually fascinating to children. In this work the janitor can be of valuable assistance to the teacher and children.

Children may need to collect material on a field excursion. This should be done only with a sensible view of conservation in mind. One of the most important meanings of science is the wise utilization of materials—conservation. Plants and animals

should not be brought into the classroom unless they are to be studied and cared for properly.

It is not necessary that the teacher be able to identify the various plants and animals by name in order to conduct a successful excursion. Many good field excursions have been conducted in the elementary school with only a minimum of identification. As a matter of fact, very few scientists or naturalists are capable of identifying exactly a wide range of objects.

New Challenges Needed from Time to Time. While emphasis has been placed on thoughtful rather than on rapid reading, the teacher should be on the alert to see that the work proceeds at a pace challenging to the children. One way to accomplish this is to move on to new aspects of the subject under consideration or to new subjects. A function of a good science book is to provide new, challenging, and vital subjects for children. Careful observation of the behavior of children will give the teacher indications of whether the children are ready for new material.

Science for All the Children

This discussion suggests how important it is that everyone in a democracy, whether scientist or layman, should have an understanding of the place of science in society. Science is a powerful tool which can be used for good or for evil. If democracy is to survive, the common people must become aware of the potentialities of modern science in a world community. To produce this awareness seems to be uniquely a task for the elementary school, since the elementary school is the school of the people. The teacher, then, will need to make certain that science is made to function in the thinking of all the children. In this way the elementary-school teacher becomes an important factor in the destiny of our nation and the world.

GERALD S. CRAIG

Purpose and Plan of *Science All About Us*

Science All About Us is the first book in the series, OUR WORLD OF SCIENCE. As the name implies, it is concerned with everyday experiences common to a great majority of young children of school age. Children everywhere are constantly observing, experimenting, and arriving at conclusions in their attempts to understand their world. Many of their mistakes are the result of faulty observation and inadequate experimentation, leading to wrong conclusions. It is the purpose of *Science All About Us* to keep alive this desire of children to find out but at the same time to give guidance so that what they learn will be accurate and organized and useful to them in gaining an appreciation and understanding of the world.

The authors of *Science All About Us* have selected a few of the more important experiences of children. These have been developed to bring out very definite basic science concepts. At the same time children's ability to observe, to think, to discuss, and to generalize are fostered.

Pictures. Since the children who will use *Science All About Us* are in the early stages of learning to read, much use has been made of pictures. There is an illustration on every page. Each one is attractive, colorful, and full of meaning. The easy reading which accompanies the pictures directs the observation to the science concepts to be discovered.

Vocabulary. The total vocabulary of *Science All About Us* is 259 different words. Of these words 166 are taken from a basic word list for the first grade and are assumed as known to the pupils who use the book. There are also 93 other words which are considered new words. These new words are introduced gradually and not more than two of them appear on one page. All but ten of these new words are repeated four times or more. The reading difficulties of the text are, therefore, reduced to a minimum.

Science Words. A few of the new words introduced in the text

are science words. It is expected, however, that many more science words will be used orally in the discussion which should play an essential part in the use of the book. Children have an understanding of and an ability to use many words which they are unable to read. It is expected that the teacher will introduce the science words that the situation calls for.

Purpose and Plan of the Manual. It is the purpose of this Manual to guide the teacher in using *Science All About Us*. Complete suggestions as to the purposes, instructional procedures, and learning activities are provided for each unit or "story" in the child's text. The teacher is strongly urged to read all the Manual material for each unit before making her own plans. There should be well-directed discussion accompanying and sometimes preceding the reading of each page. This puts great responsibility on the teacher, who must lead this discussion and direct it so that the children gain science learning. In order that the teacher may be more adequately prepared the authors have written a short introduction to each unit, pointing out its general Purpose. This is followed by page-by-page Suggestions for the Teacher, showing how *Science All About Us* may be used to stimulate interest and discussion and to direct observation and thinking. Some information for the teacher is also included, but it is hoped that the suggested bibliography will be used for additional background.

At the end of the page-by-page suggestions are Further Activities which may be carried out in connection with the unit. Before taking up a unit with the children the teacher should decide which of these suggestions she wishes to follow or should plan others that are better adapted to her group. She should also assemble all the materials needed in carrying out the activities.

The page guidance suggests a method of procedure. It raises problems, and it points the way to the solution. It is not intended that the suggestions should be followed slavishly, for this would curtail the teacher's initiative and thinking, which are essential in all vital teaching. The topical statements inserted in smaller type as side headings afford a guide to the science learning to be developed.

Suggestions for Stimulating Interest in the Science Program

The success of a science program depends in large part on the teacher's attitude toward science and her skill in planning and using a stimulating environment.

The equipment and arrangement of the first-grade classroom should be as carefully planned to stimulate and satisfy science interests as it is for reading or for any other school activity.

Materials. One important aspect of this planning is the presence of stimulating materials. There should be something growing, something alive. There should be things to look at, to touch, and to experiment with. A science program does not need elaborate materials. Except for a magnet, a thermometer, a magnifying glass, and an aquarium, most of the materials necessary for carrying out a science program are the same materials that are used for good school living, such as vases, boxes, pans, and so on. It is important to have these things on hand, easily accessible when needed.

When a child brings flowers (as he often does) the teacher should have in readiness a variety of containers from which he may choose the one most suitable for these flowers. If the child brings from the playground a large piece of snow (as he often does) the teacher should have a pan in which to put the snow. This same pan may be used later as a temporary home for a visiting turtle. If a child brings a caterpillar (as he always does), the teacher should be able to provide an adequate home for it. A cardboard box with a piece of netting over the top will do. These are but a few examples of the simple materials that help to further science learning.

Science Shelf. If a teacher is to have materials on hand, ready to be used when occasion demands, there must be a convenient place for them. A certain definite space in the storage cupboard should be reserved for science materials. It should be low enough so that the children may help themselves.

A Place for Interesting Things. Teachers should arrange a special place in the room for the odds and ends of interesting things which young children bring to school. This bit of organization makes it possible for all the children to get an opportunity to see and touch. Not all the interesting things have science value; but quite frequently some interesting object, like a milkweed pod or a piece of mica stone, stimulates science interests. Later when special interests have developed, this same place may be used for more selective collections.

Telling-and-Showing Period. Teachers should plan to have a period, at least once a week, when children can show and tell about some of these interesting things. This often leads to group science interests which have great value.

A Science Table. Teachers should provide a place in the room where science experiments may be carried on by the children, individually or in groups. A special table should be used, and it should be covered with oilcloth, so that it cannot easily be injured by water or any other material which the children use.

Bulletin Board. The bulletin board should reflect the interests of the classroom. It is a most convenient place for the display of pictures and other materials which lend themselves to this kind of arrangement. Children should participate in the care of the bulletin board and should learn to make orderly and artistic arrangements of materials.

Pictures. The teacher should have a growing collection of pictures related to science subjects. These should be organized according to subjects, so that they are readily accessible when needed. Children also should be stimulated to look for pictures to be put on the bulletin board.

An Orderly Room. When children are encouraged to bring things to school and when science experiments are being carried on and exhibits and displays are being arranged, there is great danger that the classroom will be overcrowded and disorderly. This is not necessary. The teacher should see that there are not

too many interests developing at one time. As soon as an interest has culminated, the assembled materials should be taken home or put back on the shelves, making the room in readiness for the next interest.

Excursions. The stimulating environment should extend beyond the classroom. Except, perhaps, for a few schools in congested areas, the immediate environment of the school has almost unlimited possibilities for science experiences. The teacher should frequently take children on exploratory trips just to discover interesting things or happenings. At other times the trips should be taken for a special purpose stimulated by a classroom interest.

Suggestions for the Use of *Science All About Us*

Special Time for Science. A science program calls for a special allotted time on the daily program. The activities carried on at this time should be shared by the entire group. The activities will vary in nature. Sometimes the time will be spent in gathering and arranging materials, in telling about these materials or showing them, in performing experiments, and in discussions. This is also the time for the use of the text *Science All About Us*.

Why a Textbook Is Needed. Is it not better for a teacher of young children to carry on a science program without the help of a textbook? If all teachers had the necessary science background such a plan would be ideal. Unfortunately, however, a great majority of teachers are not prepared for such a program. Under the guidance of such teachers the science program tends to be opportunistic and one-sided, and the experiences are not directed toward organized and useful learning. *Science All About Us* presents a well-rounded, although not all-inclusive, program of science. It extends and enriches the child's own experience. The Manual suggestions for the teacher enable her to direct the discussion and thinking so that fundamental science learning results.

When to Introduce the Book. *Science All About Us* presents a science program through the use of meaningful pictures and

simple text. This makes it possible for children to use the book very early in the year, as early as the second or third week of school.

Readiness for the Book. There should be a science readiness for the book before its introduction. This means that the teacher should use science time during the first weeks of school to give children experiences which will awaken in them an interest in the world about them and inspire in them a genuine desire to "find out."

Most schools open early in September. Gardens are still full of blossoms, the weather is still warm, many birds and other animals are found in the gardens and woods. In fact it is still summer, and summer activities are going on all around. The most interesting events to children are those that are taking place right now. The teacher should make the most of this interest by encouraging them to talk about the things they see. She should take children on excursions and bring into the classroom materials which stimulate interest and discussion. When interest in their own summer experiences is keen is a good time to introduce *Science All About Us*, which will enrich these experiences and guide the learning.

The teacher might say, "I have some books about a boy and a girl named Jack and Susan. They have a garden, and they did some of the same things you did this summer. Should you like to see these books and find out what Jack and Susan's garden looks like?"

Naturally the children will want to see the books. Because an interest in their own environment has already been developed, they will approach the use of the science book with a readiness for what it has to offer.

Each child in the group should be given a book. The children will naturally want to examine them, turning the pages and making comments. They should be allowed to do this informally, but eventually the teacher should call the group together for a more formal introduction to the book. First of all she should call attention to the name of the book and read the title to them. "What does *Science All About Us* mean?" Let the children tell what

they think it means, but be sure they get the idea that it means seeing things all about us and learning more and more about them. "We were learning science when we found out things about our gardens."

"Now let's open the books and see Jack and Susan's home and garden." See Manual suggestions for teaching page 5. [Note. If the book is introduced at a season other than summer it is suggested that the present season be studied first and the others in regular order.]

If introduced in late summer or early autumn, the study of the seasons with the many and varied activities will furnish material for the science program until the new year. During this time frequent reference should be made to the books, but they need not be used every day. The books should be kept on the science shelf with other books related to the subject. Children should be encouraged to use them freely.

Reading the Book. *Science All About Us* is a science book, but it is also a good reading book. Its primary purpose is to teach science, but it also may be used to further reading learning. It is proposed that the book be introduced as early as the second week of school. This is earlier than reading books are introduced. In most schools this is the time for the informal teaching of reading which develops a readiness for the more formal reading which follows.

An informal readiness program proposes to give children experiences with written material in such a way that it develops a desire to learn to read. These same experiences should help children to begin to develop reading habits and skills which are a vital part of any reading program.

Science All About Us provides excellent material for the informal "readiness for reading" type of teaching. The content of the book is meaningful to children because it depicts everyday experiences. This is one of the essentials in a beginning reading program. The pictures express the meaning, making the understanding of the text easy.

Let us look at some of the reading-teaching possibilities on

page 5. Suppose that the book has been introduced about the second week of school and that it was introduced for the science purpose suggested above; that is, to find out about Jack and Susan's summer experiences. After looking at the picture and discussing the science aspects of the page, the teacher should call attention to the reading. She might say, "The name of this story is 'Summer.' Do you know where it says *Summer*?" If a child gives the correct answer, the teacher should ask him how he knew that that word was *Summer*. The child may not know; or he may say, "Because it begins with S"; or he may say, "Because it is at the top."

The last two answers show that the child already has some reading skill. The teacher should use this opportunity to give other children these skills. She may emphasize the fact that looking at the beginning of a word is a good idea, and she should add further that you can hear the sound of S when you say *Summer*. Let the children say the word, but be sure that they know which word and which letter is being talked about. The second answer, "Because it is at the top," should be discussed, too. Knowing where to look for the name of a story is an important reading skill.

If a child does not contribute these two good ways of finding the word *Summer* the teacher should make the contribution herself.

When the title of the story has been read, the teacher may say, "Now let us read the story of 'Summer.' I'll do the reading, and you look at your books. I'll begin right under the name of the story." Be sure that the children have the right place. The teacher reads, and remarks that the story tells us something we wanted to find out. It tells us how Jack and Susan's home looked in summer. After the teacher reads the story she says, "Who knows where it says 'This is the way Jack and Susan's home looks in the summer'?" If a child shows the correct place [use a marker to show the place] ask him how he knew. [*Note.* These *How do you know?* questions are for the purpose of finding out what clues children are using. Sometimes they are not reading clues at all but wild guesses. The teacher's purpose is to develop the use of good reading clues.]

Knowing that the beginning of a story is at the top is a good reading learning, and it is the one which the teacher wishes to teach at this time. The end of the story, "in the summer," is at the bottom of the page; so it will be easy to find. These are important reading learnings that many teachers fail to teach and so cause many children to have difficulty in learning to read.

The teacher may ask, "Who knows where it says Jack and where it says Susan?" The discussion of the answers to this question gives opportunity for children to learn that the names of people begin with capital (or big) letters. For that reason the names Jack and Susan are easy to find.

The answer to the question "Which word says Jack and which says Susan?" gives opportunity for children to learn to recognize and learn the sound of *J* and of *S*.

There are even more possibilities for the teaching of reading on page 5. The teacher may not wish to use all these suggestions on this one page, but the succeeding pages offer these and other opportunities for teaching reading.

The first forty-three pages should be read in much the same manner as page 5, with the teacher using every opportunity to develop reading learnings. [*Note.* It is assumed that the teacher knows what fundamental reading habits and skill are and also how to teach so that children learn.]

The teacher always takes the responsibility for reading the text, but as the children acquire reading habits and skills (as a result of her teaching) they will gradually assume more and more responsibility for the reading. The fact that there is much repetition in the text used for all of the seasons gives children an opportunity to use their newly acquired habits and skills with considerable success. Success is one of the greatest factors in learning to read.

Later Reading. Page 44 will probably not be used for science teaching until after Christmas. By this time many of the children will have considerable reading ability. Since the vocabulary of *Science All About Us* is taken from a basic reading list, children should have little difficulty in learning to read the text. The

teacher, however, must continue to teach children to read just as she does at regular reading periods.

The Slow Readers or Nonreaders. Some of the children will not have sufficient ability to read the text. They may, however, be the very children who have the most interest and ability in science. They should not be excluded from the science program because of their inability to read. They can look at the pictures, participate in the discussions, and even in the reading by attending to the oral reading of the more able children. This situation will give impetus to the reading of the able children by providing them with a real audience situation and a real need for reading.

The teacher should use every opportunity to include the non-readers in the reading by using with them the methods suggested for the first forty-three pages.

The reading guidance given to the rest of the children should be the same as used in other reading situations. The Manual gives page-by-page suggestions for developing science learnings. The discussion of the science also helps reading. During the discussions the teacher should direct the thinking and conversation so that the words and phrases and statements and questions used in the text are used in the conversation. This is particularly necessary with some of the science words: *evaporation*, *magnet*, *clouds*, *float*, *sticky*, and so on.

Suggestions for Reading Pages 44-45. Call attention to the word *Animals*, page 44. Tell the children that this is the name of a new chapter. [The word *chapter* has more meaning to children than *unit*.] If the children do not know what the word is, do not tell them. Ask them to look at the pictures and see if they can discover what the chapter is about. Surely some child will contribute the fact that it is about animals.

"Now let us look at the name of the story on page 45." One of the reading skills which should have been developed through reading the first forty-three pages is skill in seeing likeness in words. The children who have this skill will recognize the word *Animals* in the title. Other words in the title may be unknown. Instead of telling the unknown words the teacher may say, "Let

us read the story, and perhaps that will tell us the name." [Note. If the teacher tells the name at this point it may lessen the science interest in the story.]

The teacher may now say, "Let us look at the picture." The boy will be recognized as Jack; so this should help the reading of his name. In discussing the picture the teacher should direct the conversation so that the idea is brought out that Jack has a surprise. The use of the word *surprise* in the conversation is important.

The question "What is Jack saying?" will call forth many replies, but among them will surely be "I have a surprise." At this point the teacher says, "Yes, that is just what he says. Look at the first line." Call on a child to read what Jack says. "The next line tells where Jack has the surprise." Ask a child to read it. Now ask another child to read all that Jack says. The child reads the first two lines.

"What do you think the children are saying?" If children do not suggest it the teacher might remark that they are asking a question. She may say, "I know because I see the question mark. In fact they are asking two questions just alike."

Among the various responses will be the correct one, "What is it?" The teacher recognizes this correct answer and asks the child to read it. Then she may say, "Do you think Jack is going to tell them? What does he want them to do?" The obvious answer is "Guess." So the last line is easily read.

"Now we have read the whole page. Who wants to read it again?" Let several children read it. Choosing one child to be Jack and allowing the group to take the part of the children will greatly increase interest and pleasure. Before going on to the next page be sure to let the children guess what Jack has in the box. For science learning, see Manual suggestions for teaching page 45.

The reading of the other pages of the story should be directed in much the same manner. After reading the last page of the story, page 53, do not forget to return to the name of the story on page 45. Now it can be read. Ask the children if it is not a good name for the story.

This story, as well as many others in *Science All About Us*, has a plot and good story form. For this reason the children will enjoy reading it over and over to themselves and to other children. The books should be kept on a shelf easily accessible for this purpose.

These suggestions for reading "Animals Are Alive" are given to show that *Science All About Us* provides opportunities for learning to read as well as science learnings. The other stories in the book should be presented in much the same manner, but the possibilities for teaching may differ.

As has been said before, many of the words used in *Science All About Us* have been taken from a basic reading list. The new words are introduced gradually. The words used to develop the science content should, like all other new words, be used in the discussion which precedes the reading of each page.

Evaluation. The success or worthwhileness of a science program for young children should be evaluated, or measured, in terms of changes that take place in the children. This kind of evaluation means that the teacher observes the reactions of the group as well as the individual children and measures growth in terms of evidence. Three principal kinds of change should be noted.

CHANGES IN ATTITUDE

The first changes the teacher should look for are changes in attitude toward science. These changes will be evidenced by

- more awareness of the environment
- more interest in and participation in science activities
- more contributions to discussion
- bringing of more materials

CHANGES IN SKILLS AND HABITS

These changes will be evidenced by

- keener observation
- more accurate thinking
- more ability to carry out experiments
- greater ability to use books and other sources of information
- increased use of science vocabulary

CHANGES IN ABILITY TO MAKE USE OF SCIENCE KNOWLEDGE

Changes of this kind will be evidenced by

more ability to apply knowledge learned in one situation to another situation.

EXAMPLE. Child learns that heat makes evaporation take place more rapidly; so he puts his wet mittens in the sun or on the radiator.

more ability to use knowledge for better living.

EXAMPLE. Child consults thermometer to find out how to dress for the weather.

Not all of the children in a group will develop at the same rate or in the same way. A teacher should guard against evaluating her program in terms of a few outstanding children. A good science program should provide opportunity for each child to progress at his own rate.

AGNES BURKE

I. THE SEASONS

PURPOSE

There are changes taking place on the earth all the time, but the most easily observed are the seasonal changes. The four seasons have characteristic weather conditions which affect plant and animal life and call for human adjustments of many kinds. A study of the seasons makes children increasingly aware of changes taking place around them and helps them to make more intelligent adjustments.

The four seasons recur in regular order, and one cycle of seasons constitutes a unit of time, a year. Children have a very vague concept of time. They measure time in terms of events, such as, "It was when I had the measles." A study of the seasons gives them an awareness of the fact that certain events occur and recur in regular order and thereby helps them to develop a more definite concept of time.

"The Seasons" and the suggested further activities give opportunity for children to become more aware of seasonal change and to learn that

Changes are taking place on the earth all the time.

There are four seasons: summer, autumn, winter, and spring.

The seasons recur in regular order, and one cycle of seasons is a unit of time, a year.

The seasons have characteristic weather conditions.

People, animals, and plants are affected by seasonal change and make many adjustments to meet changing conditions.

Summer (Pages 4-13)

SUGGESTIONS FOR THE TEACHER

The first season to be studied is summer. When children return to school after vacation it is still summer; so the teacher may count on their interest in the activities of this season. She should utilize this interest and direct it so that it leads naturally to a study of other seasons.

The pictures are full of meaning and should stimulate much discussion. The reading accompanying the pictures is very simple,

and the same text is used for the four seasons. The chief value of the text is that it gives direction to the spontaneous conversations of the children. It directs attention to the characteristic seasonal conditions and to the everyday lives of people, animals, and plants, and shows how they are affected by seasonal change.

The study of each season follows the same general plan. The same family and the same house, garden, and farm are pictured in the four seasons. The other activities are treated in like manner.

The seasonal activities depicted in *Science All About Us* were selected because they represent the activities common to a large part of the United States. It is quite evident that there will be places where, for climatic reasons, some of these activities will not be common. In that case the teacher should use the text as a stimulus to the study of the immediate environment to discover the local adjustments necessary for seasonal change. For example, in some parts of our country fathers do not put on storm windows to get ready for winter, but they do have to prepare for the kind of winter they expect. Let the children discuss these preparations.

There will probably be fewer differences in seasonal activities in the various parts of the country in summer than in any other season. This is a good reason for beginning the study of seasons with the summer season.

When talking about any one season there will be constant reference to the other seasons. For example, when talking about plants children will want to see the picture of the garden in every season. These pages will be easy to find, for they are numbered 7, 17, 27, 37. The other topics are numbered by 10's also. Children will be interested in this arrangement and will probably incidentally get some mathematical learnings.

Summer is a season
A season is a part of a year
There are four seasons

Pages 4-5. After looking at the picture, but before the children are allowed to talk freely about it, the teacher should see that they know that it depicts a summer scene. She may ask, "Can you tell from the picture what time of year it is?" No doubt they will all know that it is summer. Then get from the children

if possible, or tell them if necessary, that summer is a time of year. It is called a season. It is the summer season. There are other seasons, too. Ask, "Do you know the names of any other seasons?" Get as much information as possible from the children about the other seasons. Sum up their discussion by saying, "There are four seasons—summer, autumn, winter, and spring. We are going to find out as much as we can about all of the seasons."

If it is summer when this study is taking place, the teacher should be sure that the children know that they are living in the season that the picture depicts. In this way the attention is again directed to the picture.

Many summer days are warm and sunny

When looking at the picture of Jack and Susan's home, the children should be allowed to talk freely about what they see. By her questions and skillful direction of the conversation the teacher must see that the children notice the things that are characteristic of summer: the great variety of flowers, the garden getting lots of sunshine, the trees giving shade along the street and in the yard, the birdbath, the outdoor furniture, and so on. These are but a few of the many summer conditions observable. The children should be encouraged to tell about their own homes and gardens.

There may be some apartment-house children whose experiences have been chiefly on city streets. They will recall that many hours of bright sunshine made the city streets hot and that the cool evening was the best time for play. They may not have seen many flowers, but they may have had some park experiences where they saw flowers and trees and grass.

It rains in summer

In order to bring out the fact that not all summer days are alike but that weather varies within a season the teacher should ask questions which will direct attention to the fact that there are rainy days in summer too. Rain is needed to make things grow.

Some summer days are cool

Also there are some cool days in summer, when it is more comfortable to sit in the sun than in the shade. It will be too early in the year for children to be interested in a weather chart or to

have the ability to keep it, but the teacher should stimulate an interest in changing weather conditions by commenting on any weather changes and encouraging children to talk about them. This informal way of calling attention to variety in weather will eventually develop a readiness for keeping a weather chart, which is a record of weather conditions.

Summer on the farm is a busy time

Page 6. For many children this picture of Uncle Henry's farm will recall their own farm experiences; but for others who have never seen a farm the enjoyment of the picture will be purely a vicarious experience. There should be much detailed conversation, so that these children will be sure to observe and recognize the cornfield, the apple trees, other kinds of trees, the farm buildings, the barnyard, the animals, and so on. The teacher may ask such questions as "What is Uncle Henry doing? What are the cows doing? Where are the geese going?" The children should understand that summer on the farm is a busy time.

This experience should be supplemented with pictures of other farms and farm activities. A visit to a farm at this time would be most desirable, especially if this unit is studied while it is still summer.

Summer is the growing time for plants
There are many kinds of plants

Page 7. This gorgeous picture of a summer garden cannot help but convey the idea that summer is the growing time for plants. The various kinds of plants should be noticed: trees, bushes, vines, grass, and flowers. Some children will no doubt recognize some of the flowers because they have the same kind in their gardens. Encourage children to talk about their own gardens and to bring flowers from their gardens. The names of the flowers should be learned if possible. In summing up the discussion of the picture the teacher should see that the children are aware of the fact that warm, sunny summer days and summer rains are necessary if plants are to grow as these have grown.

Some animals are helpful in a garden

Before leaving the discussion of the garden special attention should be given to the presence of the birdbath. Ask, "Why do we put a birdbath in the garden?" To provide water for the birds, of course, but also to attract birds to the garden. "Why?" Be-

cause they eat harmful insects. Then ask, "Do any other animals come to the garden?" "What ones?" There is food for them there, and many animals come to eat and get fat. This does not always help the garden.

Animals are active in the summer

Page 8. This page is intended to stimulate a discussion about a great variety of animals in order to show that there are many animals about in the summer. Probably most children will recognize the cows, the bees, and the housefly, but many will need to be helped to identify the woodchuck.

Some animals help people
Some animals do not help

Some of the summer activities of animals are helpful to people. Ask, "Which animals in the picture are helpful? Which are not helpful?" Let children also talk freely about their own experiences with animals.

Animals adapt to summer conditions

The cows standing in the pool in the shade show an adaptation to summer conditions. Ask the children to tell about ways that some other animals keep cool in the summer.

As the pupils discuss this page and others similar to it, attention should be directed to the kinds of birds and animals found in the particular local environment.

People are busy in the summer

Page 9. This page turns the children's attention to activities of people, and these few pictures are intended to call forth discussion. The teacher should guide the discussion so that children are aware of the summer conditions which stimulate these particular activities. Since it is the growing time for plants, the garden needs much work, and the grass needs to be cut often. It is a very busy time for the farmer. Turn back to page 6 and see all the work Uncle Henry has to do.

People like to be outdoors in the summer

Summer is also the time for vacations; so there is time for play too. The long hours of daylight and the warm, pleasant weather make people want to be out of doors as much as possible. Ask the children, "Besides fishing and having picnics what do people do for fun out of doors in summer?"

Children play out of doors in the summer

Page 10. Children's summer activities will probably be discussed in connection with the activities of Father and Mother. Summer is vacation time for children; so the emphasis should be on play, and especially the kind of play that is characteristic of this season, like swimming and other outdoor sports. Except for rainy days most summer play is out of doors. Let the children tell about their summer play. The play of city and inland children should not be overlooked. Play with the garden hose and the water sprays provided by the city should be recalled.

It is very hot in the middle of the day

There is so much daylight in summer that the play time is very long. Ask such questions as, "Does it ever get too hot to play?" "What is the hottest part of the day?" The middle of the day is usually very hot. So early morning and evenings are good play times.

Children's summer work might also be discussed, for many children take care of their own gardens and help in the family garden.

There is more daylight in summer than in any other season
The sun is up at seven o'clock in the morning in summer

Pages 11-12. Reference has already been made to the length of summer days. Directing special attention to "getting up" and "going to bed" makes children more aware of this. Jack and Susan go to bed and get up at seven o'clock. There is a picture of a clock in each seasonal picture of these activities. Be sure to read the time.

The sun comes in the east windows in the morning

The purpose of the discussion on these pages is to observe that with the changing seasons, the conditions at seven o'clock, both morning and evening, change. It will be noted that in the summer there is not only daylight but sunlight at seven o'clock, morning and evening. In the morning the sunshine comes into the children's rooms; in the evening it does not, but it is shining outdoors. Why is this so? Their windows are on the east side of the house, and the sun comes up in the east. The setting sun shines in the windows on the other side of the house.

Other things in the picture which should stimulate conversation

are the open windows, the lightweight bed covering, the flowers in Susan's room, the kinds of toys, and the sun clothes the children are putting on. Dressing and undressing takes very little time in summer.

The sun is still up at seven o'clock in the evening in summer

All the children will be able to testify that it is difficult to go to sleep when it is still light and will enjoy Stevenson's poem "Bed in Summer."

Sunshine is good for our bodies
Too much sun burns the skin

Page 13. The kind of clothing worn in the summer has probably already been discussed in relation to other activities. The purpose here in further discussion of summer clothing is to help children make intelligent adjustments because they know the good and bad effects of summer conditions. Some of the points to be brought out are

On most summer days we do not need clothing for warmth. Sunshine and air are good for our bodies, and that is why Jack and Susan wear sunsuits.

If a person stays in the hot summer sunshine too long, his skin burns. Sunburn hurts, and too much sunburn is harmful to the skin.

Jack and Susan wear wide hats in the middle of the day to keep the hot sunshine from their bodies and especially from their heads.

FURTHER ACTIVITIES

Excursions. Wherever and whenever it is possible, children should be taken to see and experience for themselves the conditions discussed in class.

Gathering and Arranging Flowers. Since summer is the flower time of the year, this season should offer many opportunities for the enjoyment of flowers. Try to arrange for an opportunity for children to learn how to pick flowers. Have containers of various kinds and allow the children to arrange flowers. Evaluate the arrangements as to their beauty and as to the needs of the flowers.

Collect or draw pictures which show many different kinds of summer weather.

Learn the names of many of the common garden flowers.

MATERIALS

Containers of various shapes and sizes for flowers; adequate place for collections; bulletin board for display of pictures.

REFERENCE

CRAIG, GERALD S. *Science for the Elementary-School Teacher*, pp. 272-273; Chaps. XVI, XVII. Ginn and Company, Boston, 1940.

Autumn (Pages 14-23)

SUGGESTIONS FOR THE TEACHER

Autumn follows summer. It is a time between the very active period for plants and animals and the period of least activity, winter. Autumn is a getting-ready-for-winter time. The atmosphere is cooler, and there are fewer hours of sunlight. These changes in weather affect plants and animals and people in various ways. The pictures and the text serve to direct attention to many of these changes.

In different sections of the country the autumn changes and autumn activities will differ somewhat. The teacher should use the text as a stimulus to studying the immediate environment. It will be very interesting to children to realize these differences.

Autumn is a season
Autumn follows summer

Pages 14-15. Before discussing the picture the teacher should tell the children that they are going to talk about another time of year, another season. It is the season that always comes after summer. Ask the children if they know the name of this season. Tell the children that it is the season for getting ready for winter, which is the next season.

There are many changes in autumn
Leaves change color and fall from trees
Some plants die
There are many seeds on plants

Throughout the study of autumn there will be constant reference to the summer pictures. Let the children talk about the

changes they see in Susan and Jack's home because it is autumn. The teacher should direct their observation so that they see the conditions which are characteristic of this season. The leaves have changed color, and many have fallen to the ground. The trees give less shade. The apples are red and ripe. There are fewer blossoms in the garden. Some plants are dying, and there are seeds where the blossoms used to be. The grass is getting yellow.

The teacher should point out that this is a sunny autumn day but that there are rainy days in autumn too. Day-by-day references to various kinds of weather will give children a realization that while seasons have characteristic weather conditions there may be a variety of kinds of weather within the season.

Autumn is harvest time

Page 15. Uncle Henry's farm looks different, too. Ask the children, "What are some of the things that make it look different?" The house and barn are seen more plainly because the leaves are falling from the trees. Some trees keep their leaves. These are evergreen trees. There are apples on the apple tree, the corn is cut, and the pumpkins are ripe. The barn is full of hay.

It is the time for gathering and storing food for winter

The teacher should have more pictures of the farmer gathering and storing different fruits and vegetables. Special attention should be given to the local harvest, which may be oranges, nuts, and grapes. The emphasis should be on the farmer's work in gathering the harvest. If this part of the unit is studied during the autumn, plan a trip to a farm to observe the seasonal changes and the seasonal activities.

Page 17. The teacher might say, "Look at Jack and Susan's garden now! What changes do you see?" The children will see the changes, but the teacher will have to direct and guide their conversation so that the meanings of the changes are understood. This can be done by questions which stimulate thinking. The

teacher may have to supply information, but she should do this in such a way that it helps children solve problems.

Plants get ready for winter

The children will notice that the garden is not so pretty. There are fewer blossoms. The plants have stopped growing. Some of them have died. Ask, "How will Jack and Susan have a garden next year?" Call attention to the seeds on the plants where the blossoms used to be. These seeds when planted next year will grow into new plants.

There are few flowers but many seeds in the garden

The bushes and trees are losing their leaves, too. They have stopped growing. Ask, "What is it about autumn that makes plants stop growing?" Perhaps the children will not be able to answer this question now, but before they have finished the study of autumn they will learn that the weather is cooler and that there are fewer hours of sunlight. These conditions affect growth of plants. The plants in the flowerpots are being taken indoors, where it will be warm. They can keep on growing.

In the autumn animals get ready for winter

Page 18. The discussion of this picture should be so directed that ideas are developed concerning the adaptations of animals to autumn. Because of changed weather conditions which make it hard to keep warm and get food, animals have to change their ways if they are to survive. Some, like the squirrel, gather food and store it so they will have something to eat when winter comes.

Animals get ready for winter in many different ways

Some animals, like the turtle, crawl into the mud and sleep all winter. This is called hibernation. Hibernation means passing all or part of the winter in a sleeping or resting stage. The teacher should use the words *hibernate* and *hibernation*, and after the children understand their meaning they will use them, too. Snakes, toads, and frogs hibernate in much the same way as the turtle. Have the children think of other hibernating animals, such as bears, chipmunks, and woodchucks.

Some animals, like wild geese, fly south, where it is warm and where they are able to get plenty of food. We say that they

migrate. Use the words *migrate* and *migration* freely, so that the children will become familiar with them and will use them also.

Some animals, like the caterpillar, make cocoons or chrysalises and stay in them all winter. The caterpillar in the picture is the larva of a Cecropia moth. Soon it will spin its cocoon on a twig like the one shown here.

Some insects do not live through the winter, but before they die they lay eggs which hatch in the spring.

Look about you and see what animals in your part of the country are doing to get ready for winter.

As the children talk about each animal in the picture, encourage them to name other kinds which prepare for winter in similar ways.

Fathers and mothers get ready for winter

Page 19. The discussion of this page will bring out these observations: fathers and mothers are busy in autumn too; in this picture Father is putting on storm windows to keep the house warm in winter. Some children may not be familiar with this practice. The purpose of the storm windows should be made clear to them. There is plenty of fruit in the autumn. There is more than we need; so Mother is canning some to be eaten later in the winter when fresh fruit is hard to get. There is much work to do in the autumn, gathering vegetables and fruits and covering the plants. Families prepare for autumn by getting a coal supply. These activities will stimulate interest in looking around to see what people are doing in preparation for winter. Some children may suggest that their families use oil or gas for fuel instead of coal.

If you live in an environment where the activities pictured on this page are not practiced, ask your pupils, "Are any of these kinds of work not necessary in your part of the country? Why?" Then ask, "Are there some other kinds of work that we need to do in the autumn?"

In autumn children play in leaves

Page 20. Before opening the books and looking at this picture ask the children if they can think of something they can do in autumn that they cannot do at any other season. Even if they

do not think of playing in leaves, it will make the discussion of the picture much more meaningful. The emphasis should be on children's activities peculiar to this season, such as gathering nuts and apples and making jack-o'-lanterns. This is also a more comfortable time for playing running games, because it is not so hot as summer.

Ask your pupils, "Do you have the same kind of autumn fun as Jack and Susan? If not, why not? What is your favorite autumn fun?"

The sun rises later in autumn than in summer

The sun sets earlier in autumn than in summer

Pages 21-22. Seven o'clock is still "getting up" and "going to bed" time for Jack and Susan. Refer to pages 11-12 and notice changes in the autumn pictures. There is no sunlight coming in the window in the morning, but we can see the sun just coming up. It makes the room light enough to see. At "going to bed" time it is still light enough to see. The teacher will ask such questions as, "What other differences do you see in the children's rooms?" "How about their clothing?" "Is it as easy to get dressed in autumn?"

The weather is cool in autumn

Children wear warmer clothing in autumn

Page 23. Further discussion of children's clothing will be stimulated by this page. Ask, "Why do Jack and Susan wear more clothing now?" The weather is cool; so Susan and Jack have to wear clothing which will keep them warm but not too warm. Sweaters are good for this kind of weather. In the middle of the day when the sunshine is hottest children take off their sweaters. In the early morning and late afternoon they put them on again.

FURTHER ACTIVITIES

If the study of autumn is taking place in the autumn season, these activities may be carried on as the textbook is used. Otherwise they should, if possible, be used at the appropriate time.

Excursions. Take children on walks to observe changes. Gather colored leaves. Collect seeds of all kinds. Go to a fruit or vegetable store to look at the harvest. Look for evidences of animal

preparation for winter, such as birds gathering to fly away. Look for cocoons and bring them into the classroom. Look for evidences of man's preparation for winter, such as putting in coal and buying warm clothing.

Collections. Provide an adequate place and encourage children to bring fruits, vegetables, nuts, and other seeds.

Pictures. Collect or draw pictures of autumn which show different kinds of autumn weather.

MATERIALS

Containers of various shapes and sizes for flowers; containers for saving seeds; adequate place for collections; bulletin board for display purpose.

REFERENCE

CRAIG, GERALD S. *Science for the Elementary-School Teacher*, Chaps. XVI and XVII. Ginn and Company, Boston, 1940.

Winter (Pages 24-33)

SUGGESTIONS FOR THE TEACHER

Winter follows autumn

Autumn has been referred to as a time for getting ready for winter; so it will be quite obvious to children that winter is the season that follows autumn.

The study of winter should be taken up in much the same manner as the study of the other seasons. There should be constant reference to the characteristic weather conditions and activities of autumn and summer and perhaps even some looking forward to spring.

Probably the greatest seasonal difference in the various parts of the country will be found in the winter season. This difference should make the study of winter very stimulating in every part of the country. The study of local winter aspects and activities and the reasons for them will take on increased significance.

It is cold in winter
It snows in winter
Homes must be heated in winter

Pages 24-25. The seasonal changes are very easy to see in this picture. The ground is covered with snow. This will need some

discussion, for some children may never have seen snow. In many parts of the world, however, this is a natural winter phenomenon. When there is snow on the ground, the air is cold. Ask the children to discover other things in the picture which show that it is cold. For example, there is smoke coming out of the chimney. This tells us that some of the coal which was put in the cellar in the autumn is being used now to keep the house warm. The children may want to tell that coal is not the only fuel used to heat their houses.

Not all winter days are sunny

The trees are bare and do not give any shade at all. Discuss the questions, "Do people want shade in the winter? Why not?" The teacher should be sure to call attention to the fact that not all winter days are sunny. Some days are dark and the sky is gray. Sometimes it snows.

In winter farm animals stay indoors most of the time

In winter the farm animals eat food which the farmer raised in the summer and stored in autumn

Page 26. Snow covers Uncle Henry's farm too. In comparing the winter picture of the farm with the two previous ones the children should be helped through questioning to notice the absence of animal life. For example, the teacher may ask, "Where are the animals that were so active in the summer?" They are all in the barn, and the doors are closed to keep them warm. Uncle Henry has to feed them. He gives them hay and corn and oats that he grew in the summer. He put it away for winter, when the animals cannot go to the pasture to find their own food.

In winter there is little food for birds

It should be noticed that some trees on the farm have not lost their leaves. These are evergreen trees. The few birds that stay here in the winter find good shelter in these trees. Ask, "Where do these birds find food?" "Do you see any food for them?" Notice the dead plants with seeds on them, sticking up above the snow. Winter birds eat the seeds.

The teacher may ask, "What is Uncle Henry doing?" He is cutting trees so he can have wood to burn. Winter is wood-cutting time.

Plants outdoors stop growing in winter
Plants rest in the winter
Snow protects plants and seeds

Page 27. In the discussion of the snow-covered garden the emphasis should be on what really is taking place in the garden. There is nothing growing now. Many of the summer plants died, but the trees are not dead. The bushes are not dead, and many of the plants are not dead. They are resting. Their roots are alive, and the snow makes a warm blanket to keep them from getting too cold. When winter is over, they will grow again. This anticipation of things to come looks forward to the next season.

Plants continue to grow in winter if they are taken indoors

Be sure to call attention to the plants in the house window. They are growing. What makes them grow?

Animals get ready for winter in many different ways

Page 28. These pictures show a variety of ways in which animals make adjustments to winter conditions. After discussing them briefly refer to page 18, which shows animal preparation for winter. Ask the children what the turtle is doing. Help them to recall what they learned about hibernation. Then tell them that the animal in the lower left-hand picture on page 28 is hibernating. Ask them if they know what kind of animal it is. If no one knows, tell them it is a woodchuck. When cold weather comes, the woodchuck crawls into a hole and goes to sleep. He does not eat all winter but lives on the fat which he stored in his body during the summer. Look again at the picture on page 8, which shows a woodchuck eating.

It is difficult for animals to find food in the winter

Recalling the fact that some animals hibernate and others migrate, the children will not be surprised that now there are fewer animals to be seen. The teacher may ask, "What happens to the animals that are left?" Discussion about how they find food and keep warm will bring out the fact that man helps some of the animals. Talk about the importance of bird-feeding stations during winter and especially when the snow is deep and covers up the seeds and other natural food. The birds at the feeding station in the picture are, from left to right, a tree sparrow, a junco, a cardinal, and a downy woodpecker.

Some animals have heavier coats in the winter

The blanket on the dog should bring up for discussion another adjustment which animals make to winter conditions. Animals with fur or hair get a heavier coat in the winter to keep them warm. Ask, "Why, then, does the dog in the picture wear a blanket?" This is a city dog that lives indoors most of the time; so he does not adjust to cold weather as do dogs that live out of doors most of the time. The city dog's owner puts a blanket on his dog on very cold days.

Different kinds of animals make different tracks in the snow

The animal tracks in the snow will call for interesting discussion. Bring out the fact that there is more than one kind of animal in the woods because the tracks are different. Notice the rabbit tracks. Ask the children if any of them have ever seen rabbit tracks in the snow. Some children may wonder what other kind of tracks are shown in the picture. Those in the middle are muskrat tracks. Those at the right of the picture are the tracks of a fox.

Animals are sometimes very hard to see because of their color

Ask, "Why is it difficult to see the rabbit in this picture?" It is so much like the color of the snow. This brings up the interesting subject of protective coloring. Some rabbits are brown in the summer, and then they look like the ground. In the winter their fur is white, and they look like the snow. Ask, "How does this help the rabbit?" The rabbit is protected from its enemies because it is difficult to see. All of these facts should be brought out in discussion, the teacher supplying the information only when it cannot be given by some child in the group.

In summing up the discussion of animals in winter the teacher should emphasize the fact that the animals that do not hibernate or migrate [these words should be used, as the meaning should be understood now] have a difficult time finding food and protection in winter.

Autumn preparation makes winter more comfortable
Father has special winter work

Page 29. Refer to page 19 to see what fathers and mothers did in the autumn to get ready for winter. Ask such questions as, "What are they doing now?" "Is it a good thing that they pre-

pared for winter?" "Why?" "What work does Father have to do in winter that he does not do in any other season?" Father keeps the house warm. Mother sees that the children are warm when they go out of doors. How?

If your pupils live in a warmer climate ask your pupils, "Are there any things in these pictures that your father and mother do not have to do in winter? Why?"

In winter children play in snow

Page 30. For children who have experienced winter this picture will call forth much conversation about their own snow activities. From these conversations the teacher by her questions and comments should bring out the fact that winter days are cold and that children must be warmly dressed. Snow is wet. Winter play is fun.

Winter days are short
It is dark when children get up
It is dark when children go to bed

Pages 31-32. These pages may be discussed together or separately. Jack and Susan still get up at seven o'clock. Look at these pictures. Make sure that children notice such details as the lighted lamp inside and the darkness outside, the warm bathrobes, the extra blankets on the bed, and the clothing worn by the children. Then turn to pages 21-22 and 11-12 and discuss the differences seen. The discussion should bring out the fact that winter days are short because the sun rises later and sets earlier than in any other season. Because of the darkness in the morning it is harder for children to wake up; but because of the darkness at night it is easier to get to sleep. The children will again enjoy Stevenson's poem "Bed in Summer." Dressing and undressing takes more time because children wear more and heavier clothing.

Winter days are cold
Warm clothing protects the body from cold air

Page 33. In discussing the snow suits which Jack and Susan are wearing it should be noted that they are designed to keep the cold air away from the body. Reference to page 13 will bring out the fact that summer clothing is designed to let the warm air reach the body. The natural conclusion should be that exposure of the body to cold air is not good.

If you live in a warmer climate, ask your pupils, "Do you wear clothing like this in winter?"

FURTHER ACTIVITIES

Experimenting with Water. Winter is a good time for children to have experiences with water in its different forms. Children always want to bring snow into the classroom. This may start a whole series of experiences. Put the snow in a pan. It melts, and there is water in the pan. Leave the pan of water until it evaporates (goes into the air); or if quicker results are wanted, boil the water. When water evaporates or when it boils, it goes into the air in the form of gas and it cannot be seen. Water in the air may, however, become a liquid again.

If the boiling of the water has taken place near a window on a very cold day it will be noticed that little drops of water form on the inside of the window. This means that the water in the air, in gas form, condensed, or turned into liquid form again.

A natural illustration of this same phenomenon may be seen on a cold winter day when the air in the room is warm and moist. Little drops of water form on the inside of the window. Sometimes the moisture on the window freezes and there is frost on the window. (See *Science for the Elementary-School Teacher*, pp. 212-218.)

Keeping a Record of Temperature. Winter is a good time to introduce the thermometer as a means of measuring heat and cold. Whenever the day is very hot or very cold children as well as adults are interested in knowing just how hot or cold it is. The way to find out is to read the thermometer. A good thermometer should be included in the equipment of a classroom.

To keep a record of the temperature, put the thermometer out of doors, preferably near a window so it can be seen from the inside. At the same time each day read the thermometer and record the temperature on a calendar. It will be interesting to see that the record of the outdoor temperature will show variation from day to day. If taken at different times on the same day it will also show variation. A record of indoor temperature should show little variation if the classroom is properly heated.

Pictures. Collect pictures which show winter conditions in various parts of the country. If you have relatives or friends in different parts of the country write to them for pictures.

MATERIALS

A pan suitable for boiling water; an electric plate or other means of boiling water; a thermometer, preferably a large one, but an inexpensive ten-cent-store one will do.

REFERENCE

CRAIG, GERALD S. *Science for the Elementary-School Teacher*, Chap. XVII. Ginn and Company, Boston, 1940.

Spring (Pages 34-43)

SUGGESTIONS FOR THE TEACHER

Spring follows winter

Reference was made in the study of winter to the coming of spring, but the teacher must be sure that the children know the name of the season before beginning the study of spring. There will probably be fewer differences in the aspects of spring in the various parts of the country than in some of the other seasons. However, plants and animals may vary, and these variations should stimulate keener observation.

☐ Spring days are warm

Pages 34-35. After taking a good look at the picture and comparing it with pages 24-25, let the children talk about the changes they see in Susan and Jack's home. The first thing they will notice is that the snow is gone. Ask them then, "Where did it go?" It melted. "What made it melt?" The sun. The sun shines on the earth more hours in the spring, and it makes the air warm. Spring weather is warmer than winter weather.

☐ Plants begin to grow in spring

The children will want to discuss such questions as, "What becomes of the water when the snow melts?" "What does this do to the ground?" "When the ground is soft and damp and warm what happens?" Direct the discussion to the idea that now plants begin to grow. Then ask, "Do you see any plants in the picture that have begun to grow?" Notice the grass and the dandelions. Notice that the trees and bushes are getting leaves.

Spring sun warms the earth and air
There are rainy days in spring

The teacher should call attention to the fact that this is a sunny spring day but that not all spring days are sunny. There are many rainy days in spring. Sometimes it does not rain all day, but there are sudden showers and then more sunshine. This is a good time to keep a weather record. This can be done by recording the weather on a calendar each day.

A picture of the sun means a sunny day.

An umbrella means rain.

A sun and an umbrella means showers.

Many baby animals are born in the spring

Page 36. Compare this picture with the one on page 26. The fact that the snow has gone is probably the most noticeable change, and the children will talk about this. Ask them, "What are some of the other signs of spring?" The fact that there are so many different kinds of baby animals should be given emphasis. Many baby animals are born in the spring. The animals are all out in the barnyard now. How many kinds can the children discover?

Don't overlook Uncle Henry plowing. He is getting the ground ready for spring planting.

Plants begin to grow in the spring
Tulips and crocuses grow from bulbs

Page 37. Look at the garden now. Somebody has been very busy getting the ground ready and planting some seeds. Ask, "What kind of seeds do you suppose have been planted?" There are some blossoms in the garden already. Tulips and crocuses blossom very early in the spring. They grow from bulbs which were put in the garden in the autumn. They rest in the dark ground covered with snow all winter. Early in the spring they begin to grow. Tulips and crocuses make the garden beautiful in the spring. Let the children tell about other flowers that blossom early in the spring.

Children learn from experience

Children will learn much more about what is taking place out in the garden if they do some planting indoors where they can watch the development of seeds. Beans, pumpkin seeds, or other

large seeds may be planted in water. Take an ordinary drinking glass. Crush a paper towel and put it in the glass. Put the seeds around the sides of the glass so that they are seen. The paper towel will hold them in place. Put enough water in the glass to keep the towel moist. If you soak the seeds overnight before planting they will sprout sooner.

Plant birdseed in a sponge. Put a sponge in a shallow dish. Put enough water in the dish to keep the sponge moist. Sprinkle birdseed on the sponge. In a few days the seeds will begin to grow.

Planting an onion in water will help children to understand how a tulip bulb develops. Use a tall glass which is larger at the top than at the bottom. Fill the glass with water and set the onion in the top. If the top of the glass is too large, the onion can be held in place by toothpicks.

Page 38. These are some of the observations that will be made by the children and teacher when looking at this picture:

This is a busy time of year for animals.

The birds are coming back and are making their nests.

Mother birds will lay some eggs in the nests, and soon there will be baby birds.

The birds return in spring

The birds that flew away in the autumn return in the spring. Let the children talk about the birds that are coming back, and what they are doing. The bird shown building a nest is a scarlet tanager. The one sitting on the branch is a wood thrush. It is not important to identify the species, but the information is given here in case it is wanted.

*Animals that slept all winter wake up in the spring
There are many baby animals in the spring*

Ask the children, "Do you remember about the turtles that crawled into the mud in the autumn and went to sleep [page 18]?" Now that the warm spring days are here they will come out again. Mother turtle will have babies, too. She lays her eggs in mud, and after a time her babies are hatched.

Ask the children if they see any other mother and babies. What are they?

Now suggest that the children look at page 18 again and see the picture of the caterpillar getting ready to make a cocoon. Ask, "What is coming out of the cocoon now?" Not a caterpillar but a moth. The moth shown here is a *Promethea* moth. However, the kind of moth is not an important fact for first-graders.

Watching a moth emerge is an experience that children may enjoy in the classroom. (See Further Activities, page 53 of this Manual.)

Mothers and fathers work in spring
Winter clothing must be put away

Page 39. The comments of the children, guided by the teacher, will probably be something like this: Spring is a busy time for Mother and Father. Now the house and garden and the clothing must be made ready for summer. It is too warm now for heavy blankets and snow suits; so Mother hangs them on the line to get fresh air and sunshine before putting them away until next winter.

Screens must be put on windows to keep insects out

The storm windows helped to keep the house warm all winter by keeping out the cold winds. Now the air is warm and the storm windows are not needed; so Father is taking them off. Flies and mosquitoes and other insects are flying around now that it is spring; so Father is putting up the screens to keep them out of the house.

Spring is the time for making a garden

There is so much work to be done in the garden that Father and Mother will have work to do all spring. First they are busy getting the ground ready, then planting the seeds. If it does not rain often enough they will have to sprinkle. Then there will be weeds to pull out. Oh! What a lot of work in a garden in the spring!

The children may have other activities to suggest from their own experiences, such as, housecleaning, painting the garden furniture, and so on.

Children like to play in the warm spring sunshine

Page 40. Before looking at this page the teacher should ask the children what special games they play in the spring. Get them to express their feelings about playing out in the warm

sunshine again after the long, cold winter. The children in the picture seem very happy.

It is light when children get up in the spring
It is light when children go to bed in spring
Spring days are longer than winter days
Spring days are shorter than summer days

Pages 41-42. Ask the children, "At what time do Jack and Susan get up and go to bed in the spring?" It looks different at seven o'clock in the spring from the way it looked in the winter. Look at pages 31-32. Ask, "What differences do you notice now that spring is here?" It is not very light but Jack and Susan do not need the lamp lighted in order to see. The children are not wearing bathrobes. They are not putting on so many clothes. Look at the pictures on pages 11-12 and on pages 21-22. Notice the differences. Ask, "In which other season are things most like spring?"

In spring children need medium-warm clothing

Page 43. The most interesting observation to be made here will be the result of comparing spring clothing with the clothing of other seasons. It is warmer than summer clothing. It is about the same as autumn clothing. It is not so warm as winter clothing. Let the children discuss what this tells us about the weather in the four seasons.

Summer follows spring
There are four seasons in a year

After the study of spring the teacher should ask the children if they know what season comes next. After spring comes summer again. Review the fact that there are four seasons in the year, summer, autumn, winter, spring, and that they always come in the same order. To give children a concept of time ask what season it is now. Tell them that when this season comes again, we shall all be a year older.

In summing up the study of the four seasons ask the children such questions as: Which season is the growing season? Which season is the coldest? Which has the longest days? Which season has many rainy days? Which season comes just before winter? Which season do you like best? Why do you like it best?

FURTHER ACTIVITIES

Making a Garden. There are few activities that children enjoy more than making a garden. It should be planned for and dis-

cussed by the teacher and children some time before the actual garden-making begins. If this unit is not studied during the spring, the garden should be postponed until it can be planted. But the experience should not be missed.

The children should know the reason for the preparation of the ground before they begin to spade. Many interesting, unexpected things may happen when the spading is taking place. The teacher should be watchful to see if earthworms are unearthed, or larva of insects, or roots of plants. The reaction of children is to take the worm out of the garden and they are quite surprised when they discover that worms are helpful to a garden. Earthworms dig their way around in the earth and keep it soft.

After the soil has been spaded, it should be raked until it is soft and level. In planting the garden it is a good idea to include some seeds like radishes and lettuce, which have a quick harvest, and others which are harvested in the autumn. Pumpkins, popcorn, and potatoes are good for the autumn harvest. The products may be used by the children for Halloween or Thanksgiving celebrations.

Observing the Growth of Tadpoles. If a teacher lives near a pond she should take her children to look for toad or frog eggs. Bring some of the eggs to school in a container filled with pond water. In a few days the eggs will develop into tadpoles. It usually takes so long for the tadpoles to develop into frogs that the complete cycle cannot be observed by the children at this time, but the eggs-to-tadpoles change is most interesting. At pet stores it is sometimes possible to get half-grown tadpoles that are beginning to develop legs. These can be kept in the classroom until the change to frogs is complete.

MATERIALS

Garden tools and flowerpots; soil for indoor planting; seeds; aquarium for frog eggs.

REFERENCE

CRAIG, GERALD S. *Science for the Elementary-School Teacher*, Chaps. XVI, XVII, XVIII. Ginn and Company, Boston, 1940.

II. ANIMALS

PURPOSE

A recent study of children's interests discloses the fact that an interest in animals ranks first. Some children are more fortunate than others in opportunities for satisfying this interest. All children long for a pet of some kind, but many of them will never have this desire fulfilled except through the classroom. For this and other reasons every teacher of young children should plan to have some kind of animal in the classroom at some time during the year. When an animal is brought into the classroom, however, it should be given a home as nearly like its natural home as possible. It should be supplied with the right kind of food and protected from too much handling by the children.

Many children think of an animal as meaning a mammal and are surprised to learn that flies and ants and worms are animals, too.

This unit depicts a typical animal experience and highlights some learnings which may be developed through any animal experience. These include the following:

All animals are alive.

There are many different kinds of animals.

Animals need food, water, and air.

There are father and mother animals.

Father and mother animals have babies.

Animals Are Alive (Pages 44-53)

SUGGESTIONS FOR THE TEACHER

Element of surprise is an impetus to learning

Page 45. The element of surprise and suspense is a great impetus to learning and is used by many good teachers. They sometimes say to the children, "Look for something interesting in this room tomorrow" or "What do you think is in this box?"

Jack's teacher must have used this method, for children very quickly catch the spirit of the classroom and bring interesting things which they call surprises. Before turning the page the children should be given an opportunity to guess what is in the

box. The teacher should watch for evidences of good or poor thinking.

Things that are alive need air

Page 46. The teacher may ask, "Why does Mary say, 'It needs air'?" This question should direct attention to the holes in the box if the children have not already noticed them there. Mary's comment shows that she knew that holes in the box were for air and that "things that are alive need air." If the readers of the story are not so well informed, the teacher should use this opportunity to talk about the effect of air on living things.

Encourage good thinking
Animals and plants are alive

Page 47. There are two examples of good thinking here which should be discussed if children are to grow in ability to think scientifically. The teacher may say, "Did Miss Hill ask a foolish question when she said, 'Is it an animal?'" Some of the children may reply, "Yes. If it is alive, of course it is an animal." This would indicate that only animals are alive, a concept which should be corrected. Plants also are alive. Miss Hill's question was a good one because it showed that she knew that it might be a plant.

Good thinking is scientific thinking

Tom shows that he is thinking scientifically when he says, "I know it is not an elephant." He said it to be funny, and he chose the biggest animal he could think of to get a laugh. Another child who has not learned to think scientifically might name an animal too large for the box with no intention of being funny. In discussing Tom's remark, the teacher should call attention to his good thinking in the hope that other children will learn to think more scientifically.

Page 48. Ask, "Did Susan do good thinking?" "Why do you think so?" "Did Mary do good thinking too?"

Page 49. Help the children to name the animals in the picture and allow them to discuss them. Then ask, "Did the children who guessed these animals do good thinking?" Yes, because they are all animals and any of them could fit into Jack's box.

There are many different kinds of animals

The teacher should allow the children to talk freely about the animals pictured, and by her own contribution to the discussion

bring out the idea of variety of animals. Children whose idea of an animal is a mammal might remark that a moth or a snail is not an animal. This erroneous idea should be corrected and the concept of "animal" developed.

There are father and mother animals

Page 50. This page introduces the idea of the male and female in anticipation of the fact that there will be babies. Children may question how Jack knows that he has a father and a mother mouse. A reasonable answer would be because the man he bought them from said so. Children often ask if an animal is a father or a mother, but at this age they are not usually concerned with how you know. It is important in this case to establish the father and mother relationship in anticipation of the babies. Children at this age are not too young to be introduced to the words *male* and *female*.

Animals in captivity must have a good home

Page 51. If we have animals in the classroom, they should have a proper home and good care. The cage illustrated shows the requirements of a good cage for small animals. It affords protection for the animal and opportunity for children to observe without handling. It is hygienic and easily cleaned.

A good cage for small animals

The cage pictured or one much like it may be bought at a pet shop or an educational equipment company. A satisfactory cage may also be made by the school janitor, or even by the teacher herself if she has no other recourse.

The cage should be about 18" \times 10" \times 10". That is larger than necessary for white mice, but it is well to plan for a cage which will be suitable for other animals also, such as guinea pigs, chicks, or a baby rabbit. The top, bottom, and sides of the cage are made of wire mesh. This gives opportunity for observation of the animal by the children and affords protection for the animal. The cage proper is raised on legs about an inch high and there is a metal tray under it. This makes it very easy to keep the cage clean, for the excretion and the food which is spilled drop to the tray. The dishes and the tray should be washed every day.

Animals need daily care

Page 52. The daily care of animals is an important learning for children. Because children have not learned this lesson, many home pets suffer from overindulgence or neglect. The care of the school animal should be shared by all the children and the teacher. The teacher should plan with the children the kind and amount of food and the time for the care. Routine greatly helps in the care of animals. If conditions are right, most children look upon the care of animals as a privilege as well as a duty. Incidentally, a child's own food and eating habits are often very desirably affected by planning a balanced diet for an animal.

Food for white mice

A balanced diet for white mice is made by combining

4 cups whole wheat flour
1 cup powdered milk
1 teaspoon salt

A small dish of this food with fresh water every day and an occasional piece of apple or carrot will keep mice in good condition.

Baby mice are born
Mother mouse cares for her babies
Babies learn to take care of themselves

Page 53. This is the climax of the story, and it illustrates the climax of any animal experience for children. If the experience is to be successful, however, children's questions must be answered truthfully and simply. As a matter of fact children often do not ask questions but accept the experience naturally and are satisfied to watch and observe the development of the young. They should look for daily changes in appearance and gradual development from dependence on the mother for food and protection to ability to care for themselves.

To make the experience successful, care must be taken to protect the mother mouse from excitement; for if she becomes nervous she sometimes destroys her own babies. The mother mouse will feed her babies and take care of them if she is cared for. When the babies are old enough, they will eat the same food the mother mouse eats. The father mouse should be removed from the cage before or just after the babies are born for he often destroys the babies.

The mother mouse will make her nest of newspaper, which should be put into the cage.

FURTHER ACTIVITIES

Animals in the Classroom. All children should have firsthand experiences with animals, for the best learning comes from real experiences. Many children are living today in apartments and congested areas where it is impossible for them to have pets. This puts greater responsibility on the school for providing this necessary experience. Animals need not, and should not, be kept for long periods in the classroom, but there should be a great variety of animals staying for short periods.

Encourage children who have pets at home to bring them to school, not on a special Pet Day but one at a time, so that the children can really get to know something of their characteristics and way of living. Children usually have as pets dogs, cats, birds, turtles, fish, rabbits, chickens, ducks, and sometimes even snakes.

The teacher should plan with the children before the pets are brought, so they can be adequately cared for. Besides pets the classroom should provide experiences with other animals, such as insects, worms, and caterpillars. With little encouragement children will bring these animals too; and these are accessible in all communities, even large cities.

An aquarium may be used as a home for many kinds of animals. Filled with water it is a home for fish and other water animals. With soil and growing plants in the bottom and covered with wire mesh, an aquarium makes a good temporary home for toads and insects of various kinds.

With soil, rocks, and a pan of water in it, an aquarium makes a good home for turtles. (See *Science for the Elementary-School Teacher*, pp. 254-256.)

Teachers whose schools are located where it is possible to see animals in their natural environment should take children on excursions, not once, but many, many times, to see farm and woods animals.

Teachers in large cities should capitalize their unusual advantages in having the zoo and museums near at hand.

MATERIALS

A cage for small animals; an aquarium; dishes, pans, and so on.

REFERENCE

CRAIG, GERALD S. *Science for the Elementary-School Teacher*, Chaps. X, XIV. Ginn and Company, Boston, 1940.

Mothers and Babies (Pages 54-65)

SUGGESTIONS FOR THE TEACHER

Children are always interested in mothers and babies. Often when they see a large object and a similar small object they say, "One is a mother and the other is her baby." Since this aspect of animal life is most appealing to young children it has been used to extend and enrich the child's concept of "animal." The illustrations are full of meaning. The reading is very simple and serves to direct attention to specific things which will stimulate discussion.

"Mothers and Babies" and the suggested further activities are planned to give children opportunity to learn that

There are many kinds of animals.

Animals have babies.

Some animals have one baby at a time, and some have many.

Some baby animals look like their parents.

Some baby animals do not look like their parents at birth but grow to look like them.

Most animal parents take care of their babies.

Some baby animals need a great deal of care. Others can take care of themselves very soon after birth.

Pages 54-55. The horse and cow are two of the most common domestic animals, and yet to some children they are even more strange than wild animals seen at the zoo or in picture books. The teacher should encourage children to talk freely about their own experiences with these animals, so that she may supplement or correct their knowledge.

A baby horse is a colt

A baby cow is a calf

Some mothers have one baby

The baby animals should be referred to as colt and calf. The teacher should direct attention to the fact that these mothers each

have one baby. (Only rarely do these animals have twins.) A great many other interesting things about these animals may come up during discussion. The fact that the cow gives milk surely belongs in any conversation about cows.

Some babies look like their mothers

Pages 56-57. In connection with these pages introduce the idea that some babies look like their mothers. Some very large mothers have very small babies.

A discussion of mother care will be stimulated by the pictures. The children will observe the pocket, or pouch, in which the mother kangaroo carries her baby. A baby kangaroo stays in its mother's pouch for about ten months.

The children may be interested in learning that baby elephants grow up very slowly. Sometimes the elephant calf stays with its mother for four years, during two years of which she may nurse it.

Some mothers have more than one baby

Pages 58-59. Some animals have more than one baby at a time. Lions usually have two babies at one time. Many bears have two babies at a time, although they may have only one or as many as four.

Baby bears are called bear cubs. Baby lions are lion cubs.

Some mothers have many babies

Page 60. The children will probably have much to contribute about the mother dog and her puppies, because most children have had some firsthand experience with dogs or with puppies. The teacher should be sure to see that the idea of many babies at a time is brought to the attention of the children.

Mother animals take care of babies

Page 61. Mother care should be emphasized in talking about the hen and her chickens. Children who have had experience with a hen and chickens can contribute some dramatic evidence of this mother care. If it has not already come up for discussion this is a good time to talk about the fact that most mothers try to protect their young. It is not safe to go too near or to try to touch baby animals when the mother is near.

Babies need food

Page 62. Another mother with many babies who are very dependent upon her for protection and food is shown here. The

father cardinal also participates in the care of the baby birds. With the exception of the hen, all the other mothers thus far have been mammals, and the question of feeding may not have come up. The teacher should at this time ask how the other babies get their food. If possible, the children should be taken to see some mammal feeding its young. It should be just as natural as seeing a mother bird feeding baby birds.

Some babies look like their mothers

Page 63. The interesting thing about this picture of skunks is that the babies look so exactly like the mother. The purpose is to emphasize likeness, in order to make a dramatic contrast with the next mother and babies.

Some babies do not look like their mothers but grow to look like them

Page 64. Ask, "Can these caterpillars be the babies of this mother?" They do not look at all like her. "Will they ever be like their mother?" These are some of the questions that will stimulate interest and thought and bring out the important learnings. The children will probably need to be told that the butterfly is the mother and that the caterpillars are the babies. They must also learn that the butterfly laid the eggs from which the caterpillars came. The butterfly shown here is the Monarch butterfly.

Most children will be unfamiliar with the life story of a butterfly or moth, but this is something which can be observed in the classroom. (See Further Activities, page 53.)

Page 65. The frog and tadpoles should be discussed in much the same manner as the other animals. The mother frog lays many, many eggs, from which the baby tadpoles grow. Children who have had experiences with tadpoles or frogs should now be encouraged to tell about them. Develop the idea that these babies grow to look like the mother.

Some mothers provide for the care of their babies

Up to pages 64 and 65 the mothers pictured have all given their babies some kind of care and protection. They are mothers who stay with their babies until they can take care of themselves. Butterfly and frog mothers do not stay and take care of their babies, but they do provide for their care by laying their eggs in

a spot favorable for their development and where the babies can find the kind of food they need.

The suggestions have been directed toward carrying out the main purpose of the unit, namely the enriching and extending of the mother-baby concept. There will, undoubtedly, be developed a great many other ideas which will lead to further study of other aspects of animal life such as

Wild and domestic animals

Animal homes

How animals protect themselves

What animals eat and how they get their food

How animals move

How animals help man

FURTHER ACTIVITIES

To get the fullest value from "Mothers and Babies," the children must be given some actual experiences with mother and baby animals.

Observing Animals in the Classroom. See "Animals Are Alive" for suggestions for keeping animals in the classroom. The change that takes place before some babies look like the mothers is very interesting, and this may be observed in the classroom.

In the fall of the year look for a caterpillar. Notice the kind of leaves it is feeding upon. The mother laid her eggs near or on these leaves; so when the eggs hatch her babies will have food. Bring the caterpillar with plenty of food into the classroom. Put it in a box covered with wire netting. In time it may spin a cocoon. Keep the cocoon in the box in a cool place all winter and from time to time sprinkle it with water. In the spring bring the cocoon into the classroom. You may be lucky enough to see a moth emerge. If it is impossible to get a caterpillar, look for a cocoon to keep through the winter.

Observing Animals in Their Natural Environment. When any of the children's pets have babies, the teacher should arrange, if possible, to take the children to see them. This is better than trying

to bring the mother and baby to the classroom. Spring is the best time to visit a farm to see mother and baby animals.

The Zoo and Museum. Whenever babies are born in a zoo, it is given publicity. Teachers should take advantage of all opportunities to give children firsthand experiences with these baby animals.

The Bulletin Board. Encourage the children to look for and bring to school pictures of mother animals and their babies. These should be classified and arranged according to some plan decided upon by the group. For example, they may be arranged

According to the number of babies

According to the care and protection given

Some children may wish to make individual scrapbooks, which is an excellent idea, especially as it may lead to a permanent interest or hobby.

MATERIALS

A cage for small animals; an aquarium; dishes, pans, and so on.

Cocoons, chrysalises, and pupae may be purchased from Maynard of Rochester, 1192 Lewiston Avenue, Rochester, New York, or from other supply houses.

REFERENCE

CRAIG, GERALD S. *Science for the Elementary-School Teacher*, Chaps. X, XIV. Ginn and Company, Boston, 1940.

III. PLANTS

PURPOSE

Most children have had some experience with plants, but it is surprising how little they really know about them. This is because they have not had the guidance which stimulates interest and a desire to find out. This unit is planned to further the child's concept of living things and at the same time give an opportunity to learn that

Plants are alive.

There are many kinds of plants, differing in shape, size, and growing habits.

Many plants grow from seeds.

These plants grow and produce more seeds.

People and animals eat some kinds of plants for food.

Plants Are Alive (Pages 66-71)

SUGGESTIONS FOR THE TEACHER

Surprise stimulates interest

Page 67. Miss Hill used the element of surprise again, and she brings the surprise herself, showing that she has a definite plan and does not leave valuable learnings to chance experiences.

Before reading the page the teacher should tell the children that Miss Hill has a surprise for her pupils. Ask them to guess what the surprise is. The teacher should be particularly alert to recognize and commend good thinking. Good thinking is good science learning. Ask, "Did Jack do good thinking?" Yes. Instead of guessing wildly he narrowed his thinking down to "live things."

Jumping to conclusions without sufficient evidence should be discouraged

Susan shows that she has a limited concept of live things when she jumps to the conclusion that it is an animal. This is quite natural, but it gives the teacher an excellent opportunity to discuss with children the desirability of getting all the evidence possible before drawing conclusions.

Things that grow are alive

Page 68. Susan's statement about plants, "They do not move," shows that she based her idea of live things on ability to move.

Miss Hill introduces the concept of growth and makes a valuable generalization, "Things that grow are alive."

This will call for discussion to be sure that children understand the concept of growth. Let children talk about evidences of growth which they have noticed in the plants in the garden, their pets, their babies at home, and even themselves. One evidence of their own growth is the fact that last year's clothes often do not fit. This is a good time to give children an experience in recording their own growth. Keeping a record is a scientific procedure and a way of getting proof.

Make a record of growth

Experiment. Measure each child, putting a mark on the wall to indicate present growth. Measure again several months later.

Plants need air, sunlight, moisture, and soil

Page 69. Before the reading of this page, the teacher should ask the children where in their room they would put the plant. A child may suggest putting the plant in a dark corner because there it would brighten the room and make it look pretty. A discussion of this kind will test the children's knowledge of the care of plants and make the reading of the page more interesting and valuable.

There are many different kinds of plants

Pages 70-71. The purpose of these pages is to interest children in variety in plant life. The pictures include grass, a tree, a vine, a field plant, a bush, a garden plant, a desert plant, and a water plant. The discussion of the pictures should be supplemented by the experiences of the children. The teacher should guide the discussion so that these ideas of variety are brought out:

There are a great many different kinds of plants.

Plants grow in many different ways. Example: trees, bushes, vines.

Some plants live much longer than others. Example: trees; plants that live only one year (annuals).

Plants grow in many different places. Example: gardens, fields, woods, deserts, and in water.

The growth of plants depends upon where they live. Example: cool air or hot air, sandy soil or wet soil; and so on.

Seeds (Pages 72-74)

SUGGESTIONS FOR THE TEACHER

Interest stimulates learning

Pages 72-73. Before reading there should be a discussion about the pictures supplemented by children's experiences, for the purpose of stimulating an interest in seeds. Ask such questions as "What time of year is it?" "How do you know?" "What should you expect to find if you were in the woods?" "What is Jack looking at?" "What question is he asking?" Be sure to call attention to the big oak tree and the little oak tree.

An acorn is the seed of an oak tree

Trees grow from seeds

Plants grow from seeds. Trees are plants

Page 74. Before reading this page the children should be given an opportunity to try to answer Jack's question. This gives the teacher an opportunity to find out what children already know about seeds. It is quite possible that many children do not know that trees have seeds. The teacher should be sure to bring out the fact that each kind of tree has its own kind of seed. Only oak trees grow from acorns. Bringing the conversation to garden plants, which most children know, makes it easier for them to understand trees as plants.

More Seeds (Pages 75-80)

SUGGESTIONS FOR THE TEACHER

Page 75. After reading page 74 the natural impulse of the children will be to find acorns and the seeds of other trees. This should be encouraged. Jack and Father are looking for more seeds, too.

There are many kinds of seeds

The seeds of an apple tree are in an apple

Page 75 further illustrates the fact that trees grow from seeds and different trees have different seeds. Ask, "Where are the apple seeds?" The fact that Jack and his father ate the part of the apple which protected the seeds should stimulate a discussion about other fruits with seeds.

We eat some seeds

Sometimes we eat the seeds. Ask the children, "What seeds do we eat?" They may not be accustomed to thinking of peas and beans as seeds.

Not all seeds are good to eat

Sometimes we eat the part of the fruit which holds or protects the seed. This should be a lively discussion, and the teacher should be sure to bring out the fact that not all seeds are edible. Seeds and fruits are also eaten by birds and some other animals. Warn the children about eating berries and fruits which they find in the woods.

There are many kinds of seeds
Seeds are found in many places

Pages 76-80. The purpose of these pages is to emphasize variety in seeds and variety in places to look for them.

Page 76: Plants and seeds shown are from left to right dogwood, bittersweet, milkweed, and swamp thistle. Page 77: Sunflowers and corn are shown on this page. Page 78: Peaches are shown here. Page 79: Peas and grapes are shown on this page. Page 80: These plants include watermelon, corn, orange, walnut, milkweed, and peanuts.

In the discussion the teacher should be sure that the children identify and name the seeds illustrated. These are but a few of the many different kinds of seeds that can be found, and it is expected that children will contribute much from their own experiences. Be sure to bring into the conversation the fact that each seed when planted will grow into a plant like the one which produced the seed.

How Seeds Grow (Pages 81-83)

SUGGESTIONS FOR THE TEACHER

Page 81. An interest in planting seeds is the natural outgrowth of collecting seeds. If some planting has not already been done, it should be done at this time.

The idea of being able to plant so that the growing seeds can be seen will probably not have occurred to the children. The teacher should stimulate an interest in this activity by such

questions as "Have you ever seen seeds growing?" "Should you like to see how seeds grow?"

Plant seeds in soil
Give them water and sunlight

Page 82. This page explains in very simple terms how the demonstration with seeds can be carried on in a classroom. In the discussion of what Father did, the teacher should make sure that children know which things were done so that the seeds would grow and which so that the growing could be observed.

Lima beans are good for this demonstration. Soak the beans, or other seeds, overnight before planting. Soaking makes the seed get much larger. The seed coat slips off and the seed opens easily. With a magnifying glass the children can see the embryo plant.

Page 83. The text emphasizes the fact that after seeds are planted the soil must be kept moist. In about four days the beans will sprout. Have children observe that no matter which way a bean is planted the roots grow down and the stem grows up. Watch how the seed leaves (the two halves of the bean) come out of the seed coat and are pushed upward on the stem. Watch for the development of the true leaves.

FURTHER ACTIVITIES

Excursions. Take the children to the woods or to a park to gather seeds. City children may be taken to markets and stores to see various kinds of seeds.

Collecting Seeds. Encourage children to bring as many seeds as possible. A suitable place should be available, and the collection should be organized and arranged according to some plan, depending upon the interests of the group, such as

- Seeds used for food by people or animals
- Seeds found on trees
- Seeds found on bushes
- Seeds found on the farm
- Seeds found in the woods

Planting Seeds. Indoor planting for experimental purposes can be done at any time of year, but the best time is when interest

is keenest. Let children plant any and every kind of seed in individual flowerpots or in a window box. Of special interest will be the time of germination of the various seeds.

To round out the experience with seeds, children should have an opportunity to experience the cycle of growth from seed to the production of more seeds. This may be done in a window box in a classroom, but an outdoor garden will be even better. In planning for this experience the teacher should choose seeds of plants which mature in a relatively short time. Petunias, morning-glories, and nasturtiums are good for this purpose.

MATERIALS

Flowerpots and a window box; glass dish; soil for planting.

REFERENCE

CRAIG, GERALD S. *Science for the Elementary-School Teacher*, Chap. X; pp. 290-292, 347-348. Ginn and Company, Boston, 1940.

IV. THINGS THAT ARE NOT ALIVE

PURPOSE

After children have had experiences with plants and animals, they become more aware of things around them. In attempting to identify things, they come upon the problem of how to classify such familiar objects as stones, water, and soil.

This unit gives opportunity to learn that

The environment is composed of two kinds of things: those that live (plants and animals) and those that do not live.

Air, earth, stones, water, fire, and wind are not alive.

Things that are not alive do not grow.

Things that are not alive have many uses.

SUGGESTIONS FOR THE TEACHER

Pages 84-85. The story introduces the idea of nonliving things in a very natural way. In order to stimulate the children's interest they should be given an opportunity to examine the picture. During the conversation about it the teacher should arouse curiosity by asking, "Why do you suppose Father and Susan are looking at the rock?"

The development of a concept of time is important

After reading page 85 the discussion should be concerned largely with the concept of time. Children have a very vague idea of time. Years do not mean much to them, but "when Father was a boy" should convey an idea of a long time compared to concepts of a day or a week or a month which they have experienced. Every opportunity to clarify the concept of time should be used by the teacher.

Some things grow
Growth means change

Page 86. The children should know that this is a picture of the scene when Father was a boy. He is the boy in the picture. Refer to pages 84-85 to discover as many changes as possible. Discussion of the pictures will bring out the fact that many changes have taken place since Father was a boy. Ask, "What caused the changes?" Things grew. Then say, "Did all the things grow? See if you can find something that did not grow."

Change is taking place on the earth all the time

Children should be made aware of the fact that change through growth is taking place all over the earth and not just in this spot.

Things that are alive grow
Things that do not grow are not alive
Water is not alive

Page 87. This page introduces for the first time a way of identifying nonliving things. Things that do not grow are not alive. At this point the teacher should ask the children to look at the picture to see if they can find other things that are not alive. She should be alert to see if any of the children, like Susan, associate aliveness with movement. In the discussion it should be brought out that not all living things move. Almost all animals move, but most plants do not.

Page 88. Susan's interest in taking a rock to school indicates the kind of classroom she has. Teachers should encourage the desire to share knowledge and experiences.

Air is not alive

Father stimulates an interest in further looking about to discover things that are not alive. This is the time for children to examine their own classroom to discover iron in the radiator, glass in the windows, soil in the flowerpot, gold in the teacher's ring, and so on. Iron, gold, glass, soil are not alive. These are but a few of the nonliving things that may be observed in most classrooms.

Some things which are not alive now are made of material which was alive

Children will perhaps name things like a wooden table. Through a discussion of the material of which the table is made it will be found that the wood came from a tree which was alive. In like manner other things in the room which are not alive now can be traced to materials which were once alive. Shoes, clothing, and some baskets are a few possibilities.

Nonliving things have many uses

Page 89. This page emphasizes the fact that movement may be associated with some things that are not alive. In discussing the movement of the wind, the children may suggest ways in which the wind works for us. At this point the teacher may, if she chooses, direct attention to an area of thinking which will

be very interesting and profitable, namely, the dependence of living things on the nonliving. This will open up a great field of exploration, the possibilities of which are indicated but not elaborated here.

Animals and plants need things that are not alive

Plants and animals need air and water. Plants need soil. Some animals make their homes in the ground, some in the water. People use stones and earth and other things not alive in making homes and making things needed in homes, such as stoves and dishes. The sun is not alive, but living things need the sun for light and heat. People use water in many ways, such as for drinking, bathing, and washing. People travel on rivers and lakes and the ocean. Wind is used to move boats and windmills. These are but a few of the possibilities of this subject. The alert teacher will take children on excursions to find evidences of the use of nonliving things. A bulletin board will stimulate the collection and organization of pictures on the subject.

FURTHER ACTIVITIES

Collection of Rocks. One of the most interesting and worthwhile activities for young children is the collection of rocks. Rocks have a fascination for children and there are many valuable learnings as a result of this interest. First of all they will become familiar with the local rock, the one which is found most abundantly in the immediate vicinity. In some places it may be limestone; and it may be discovered that this local stone is used for sidewalks and the foundations of houses. It may be possible that one of the local industries is the making of lime from limestone.

Different local rocks, such as granite and marble, are used for different purposes, and they affect the lives of people in different ways.

Except for the local stone it is not possible or necessary for the teacher to identify all the stones the children bring in. It is possible, however, for the teacher to give children experiences so that they may discover for themselves many things about rocks. Among the learnings which should take place are these:

There are a great many kinds of rocks.
Rocks vary in shape, color, weight, hardness.
Rocks can be broken into smaller pieces.
Rocks are used in many ways.

Excursions. City streets as well as country lanes offer rich possibilities for the identification or collection of nonliving materials. It is remarkable how many nonliving materials can be gathered on such a trip. Try it. Let the children organize and classify the collected materials according to some plan agreed upon by the group, such as, things made of glass, stone, iron, brass, and so on.

MATERIALS

Magnifying glass, used especially in connection with stone collection.

No other special material is needed, but the teacher should plan a suitable place for collections and should have the bulletin board ready for collections of pictures.

REFERENCE

CRAIG, GERALD S. *Science for the Elementary-School Teacher*, Chap. VI. Ginn and Company, Boston, 1940.

PURPOSE

The use of the postman in stimulating an interest in weather directs the attention at once to the social as well as the scientific aspects of weather. Most children have already experienced many kinds of weather and have learned that people cannot change the weather. Since this is true, people have to make changes in their ways of living or in their plans because of the weather. Some essential activities must go on in every kind of weather, and children are not too young to have brought to their attention the slogan of the United States Post Office Department, "Not snow, nor rain, nor heat, nor gloom of night stays these couriers from the swift completion of their appointed rounds."

The pictures and the simple captions direct attention to the principal character, the postman, but they also show how weather affects the activities of other people.

From the study of the weather children will have an opportunity to learn that

There are many kinds of weather.

People cannot change the weather.

People make changes in their plans and activities because of weather conditions.

Some activities must go on in all kinds of weather.

SUGGESTIONS FOR THE TEACHER

Rain affects the activities of people

Pages 90-91. A Rainy Day. This picture will stimulate a great deal of conversation. The text directs attention to the postman and introduces the idea that some activities must go on in spite of the weather. This is the time to tell the children the slogan of the United States Post Office.

Quite naturally the conversation will turn to the activities of other people, and it is probable that remarks of this kind will be made: It is a good day for the taxi driver because so many people want to ride in order to get out of the rain. It is a good day for stores where umbrellas and rubbers and raincoats are sold. It is not such a good day for delivery men and for some

other workers. Food must be delivered and trains and streetcars and busses must continue to run when it rains. Some workmen like carpenters or gardeners who do outdoor work have to stop when it rains. The farmer cannot cut his hay and do other outdoor work, but, rain or shine, he must take care of his animals.

To stimulate further thinking about situations not pictured the teacher may ask questions such as

What do children do on rainy days?

How does the rain affect Mother's work?

What effect has the rain on animals? (Some animals like rain.)

What effect has the rain on plants?

Rain provides moisture for the earth

In summing up the discussion about the rain the teacher should be sure to emphasize the fact that rain is necessary for life. It provides most of the moisture necessary for growing things. If we had no rain we should have no gardens. On the other hand, too much rain sometimes causes damage.

When discussing this and other weather pictures the teacher should be sure to call attention to the change in clothing made necessary by weather conditions. When a scene is rural, the teacher should direct attention to city conditions, and vice versa.

Snow falls in winter

Snow makes a blanket for plants

Page 92. Snowstorm. The discussion of this picture should proceed along the same lines. Reference should be made to the study of winter in "The Seasons." It should be recalled that snow is a characteristic weather phenomenon of winter. Snow fun and the value of snow as a blanket for plants and seeds should be noted.

Summer days are warm and sunny

Warm sunny weather makes things grow

Page 93. A Warm, Sunny Day. This is the kind of weather most people like. Talk about the many activities shown in the picture. Reference should be made to "The Seasons." Recall the fact that warm, sunny weather is characteristic of summer. Summer is the growing time for plants, an active time for animals, and a busy time for farmers. It is also the kind of weather that makes people like to be out of doors. No wonder the postman enjoys his work.

Hailstones are little balls of ice which fall from the sky
Hailstones damage gardens

Page 94. A Hailstorm. Some of the children may never have experienced a hailstorm. Hailstorms are much less frequent than other kinds of weather, and they usually last for a few minutes only. For this reason the teacher may have to give the information while the children ask the questions. What is hail? Sometimes during a thunderstorm on a very hot day, instead of rain, little balls of ice fall from the sky. This is hail. It makes a knocking sound on the windows and sometimes even breaks a window. Most people go indoors when it hails. The children may ask whether the postman delivers mail in the country during a hailstorm. He still does his work. Then they may ask how he is protected. The top of his automobile protects him from many kinds of weather.

Hailstones melt after they reach the ground

Look at the picture again. Ask, "What are the children doing?" They like hailstorms. Ask, "What do you think happens to the hailstones when they are brought indoors?" "What happens to the ones on the ground?" "Why do they melt, or turn to water?" Hailstorms are short and infrequent, but farmers do not like them. The hailstones often beat down the grain in the farmer's fields. Men who own greenhouses do not like hailstones either. Ask the children if they can tell why.

Look for a rainbow when it rains and the sun is shining at the same time

Page 95. Sun and Rain Together. As the children look at the picture the teacher may ask, "What kind of day is this?" It is raining and the sun is shining at the same time. This is the kind of weather to look for a rainbow. Again the teacher may have to answer some questions. The children will surely ask, "What makes the rainbow?" The rainbow is made by the sunlight passing through the drops of water. Sometimes rainbows are made right in the classroom when the sunlight passes through the aquarium. The teacher should, if possible, get a prism and let children experiment with it. Notice that the colors are always arranged in certain order and that they blend with each other.

The postman must be prepared for changeable weather

To bring the attention again to the postman and the weather, the teacher may ask, "Do you think the postman likes this weather?" Refer to the fact that he has to be prepared for all kinds of weather. Notice his raincoat. The suddenness of the rain is what causes the inconvenience on a day like this. No doubt children will have had the experience of being caught in a storm and getting wet and then having the sun come out again.

Fog is a cloud near the earth
It is difficult to see in fog

Page 96. A Foggy Day. Most children have had some experience with fog, and they will have much to contribute to the discussion of this page. Let them tell what they know of the effect of fog on our lives. It is hard to see in fog. The postman has difficulty in seeing where to go. He has to be very careful when crossing the streets, because people driving cars cannot see well either. Fog sometimes makes it so dark that automobiles have their lights on during the daytime. People have lights on in their homes.

To stimulate the children to think of places not pictured here the teacher should ask, "What happens to boats in fog?" "Did you ever hear of an airplane being grounded?" "What does that mean?" Children may question the teacher about fog, and she should be ready with information.

Fog is a cloud. Usually clouds are high above the earth, but sometimes they are down near the earth. Then the clouds are called fog. A cloud is made of little fine drops of water in the air. When we walk through the fog, we are walking through a cloud. When a cloud is in the sky we can look at it but we are not in it. When you walk through fog little tiny drops of water get on your clothing, and you may be able to feel the moisture on your face.

During thunderstorms people try to get indoors

Page 97. A Thunderstorm. There will probably be much discussion about this picture because thunderstorms are exciting. Some children also fear them. The text calls attention again to the fact that the postman brings the mail in every weather. He seems to be hurrying because he wants to get the mail delivered

before the storm comes. During thunderstorms people try to get indoors.

It is difficult to explain the cause of thunder and lightning to children. Lightning and thunder are caused by electricity in the air, but this does not explain much. However, for the most part children are not as interested in the cause as in the effect. Some children have great fear of thunderstorms. They are also affected by the emotional reaction of adults; so it is very essential that grownups keep calm during storms of any kind.

Lightning sometimes strikes the earth
Never go under a tree during a thunderstorm

If children already know that lightning sometimes strikes the earth and that animals and people are killed, it is well to let them talk about it. However, it should be pointed out that this occurrence is rather rare, and that if people take proper precautions it is quite unlikely to happen. One of the most important things for children to learn is to go indoors if possible during a storm or, if it is not possible to take shelter indoors, to stay out in the open, not to go under trees. In finding its way to the earth, lightning often travels through trees.

Page 98. A Very Hot Day. As the children look at this picture the teacher may ask such questions as these: "Why does the postman not like this summer day?" "When you look at this picture how do you know it is a hot day?" "What makes it so hot?"

The discussion should bring out these learnings: The sun shines for many hours in summer. Sometimes there are no clouds to keep the sunlight from falling on the earth. Sometimes there is no wind to move the air. Then it is very, very hot.

It is hard to work when the weather is so hot, but the mail must be delivered. The children are having a good time, but they are dressed for hot weather. They are getting cooled off with the water. Ask, "How are the women on the porch getting cool?" The fan makes wind, and wind makes people cooler.

Very hot weather is good for growing plants

The farmers like this kind of weather. It is good for growing things. It is especially good for growing corn.

Page 99. A Very Cold Day. Ask the children, "When you look at this picture how do you know that it is cold?" The people are all bundled up in warm clothing. The postman is rubbing his hands to get them warm. "Try that the next time your hands are cold."

A thermometer measures heat and cold

It must be a very cold day. Ask the children such questions as these: "How cold is it?" "How can you tell how cold it is?" This picture introduces the thermometer as a measure of temperature. Children are much interested in thermometers and quickly learn to use them. There is no better time to introduce the thermometer than on a very cold day. (See "The Seasons," Further Activities, page 38 of this Manual.)

People prepare for cold weather

Further discussion of this page should be directed toward the effect of cold weather on the lives of people. Ask, "How do people keep warm?" Refer to the fact that people prepare for cold weather. Look again at the pictures on page 19.

People cannot change the weather

In summing up the study of weather the teacher should again emphasize the fact that the postman delivers the mail in all kinds of weather. People cannot change the weather; so they have to adjust their activities to weather conditions.

FURTHER ACTIVITIES

In the discussion of the various kinds of weather, the question of weather prediction will come up. While young children cannot understand how it is done, they should know that it is possible to predict weather with a great deal of accuracy. This ability is very important, because if we know what the weather will be we are able to plan for it. For example, if we know it is going to rain, we can take our umbrella and rubbers. The daily newspapers print the weather prediction, and it is one of the first interests of young children in a newspaper.

The teacher should show where "The Weather" is to be found in the local paper. Ask the children to look for the weather report in the paper at home and, if possible, to cut it out and bring it

to school for the bulletin board. Ask the children also if they have heard the weather reports on the radio. Many stations give a report early in the morning, so that the people who go to school or to work will know how to dress for the day.

Weather Chart. Keeping a weather chart has already been suggested. (See page 40 of this Manual.) Now that a greater variety of weather conditions has been discussed these can also be recorded.

Experiments with Water. Since the presence of moisture in the air enters into the understanding of weather conditions, the teacher should give opportunity for experimentation with water in its various forms. Put some water out of doors or in the refrigerator, to form ice. Bring the ice indoors to melt, or change to water again.

Leave some water in a pan to evaporate. It goes into the air in the form of gas and cannot be seen.

Boil water and observe the vapor. This is a small cloud. Put a piece of glass over the vapor and see the drops of water caused by the condensation of the vapor. When the drops are heavy enough they will fall. This is like rain.

MATERIALS

Thermometer; prism; pans for water experiments; electric plate or other means of boiling water.

REFERENCE

CRAIG, GERALD S. *Science for the Elementary-School Teacher*, Chap. IX; pp. 397-398, 499-500 (For specific references to rain, snow, hail, fog, etc., consult the Index of this volume). Ginn and Company, Boston, 1940.

VI. THE MAGNET

PURPOSE

Many children have magnets at home which they use as play-things. No doubt they learn many things about a magnet in this way. This unit is planned to suggest activities and to stimulate problems which will result in two definite learnings:

Magnets attract iron and steel.

Magnets are useful in helping people do work.

SUGGESTIONS FOR THE TEACHER

People use magnets to do work

Pages 100-101. The best time to introduce a magnet into the classroom is when there is a need for it. In the discussion of the picture the teacher should be sure to see that the children realize that Jack is doing work with his magnet. He knows that a magnet attracts iron. He knows that nails are made of iron. So he is using the magnet to work for him. The other children are all interested. Some are surprised, and some show a puzzled or a questioning attitude. In any group of children all these attitudes will be expressed. The teacher should be alert to recognize these attitudes in her children, so that she can give them the guidance they need.

Page 102. The activities suggested here call for the use of magnets, and the teacher should see that one or more magnets are on hand. The teacher should also plan to have on hand the different kinds of materials shown on the page as well as many other materials.

A magnet attracts iron and steel

The children with interested, surprised, and questioning attitudes should be given an opportunity for experimenting with a magnet and many different materials. They will discover that only objects made of iron or steel are attracted by the magnet.

Magnetism passes through some materials

Sometimes objects like tin cans will be attracted and will lead the children to a natural conclusion that tin is also attracted by the magnet. This is not true. There is just a thin coating of tin

on the can, and the magnetism passes right through the tin and attracts the iron which is underneath.

Page 103. The children should carry on the two experiments pictured here. If there is not an aquarium in the classroom, drop a nail into a pan or a bowl of water and try to remove it with a magnet. Before attempting the experiments the children should set up such questions as "Does a magnet work in water?" "Does the power of a magnet go through a piece of paper?" The experiments will prove that the answer to both questions is yes.

Pages 104-105. In every group of children watching a magnet being used there is always at least one child who just cannot accept the amazing power of the magnet and thinks there must be some trick about it, like something sticky on the magnet. Be sure to allow these children to do the experimenting themselves until they are convinced that there is no trick, but that magnets attract iron and steel and that magnetism acts through other materials. [Note. A magnet also attracts nickel and cobalt, but children will have little opportunity to experience this.]

FURTHER ACTIVITIES

The teacher should keep a magnet on hand at all times, so that it may be used by the children to do work such as picking up nails or recovering thumbtacks that have fallen down in inaccessible places, or to discover the presence of iron in materials.

Children enjoy play fishing with magnets. Put a magnet at the end of the fishline. Make paper fish and fasten a small nail or paper clip to each one. When the magnet passes over the fish it attracts the nail or paper clip and the fish is caught. Sometimes, if the magnet is a strong one, the fish jump to the magnet.

MATERIALS

A good magnet; a variety of materials for experimenting.

REFERENCE

CRAIG, GERALD S. *Science for the Elementary-School Teacher*, Chap. XX; pp. 438-453. Ginn and Company, Boston, 1940.

VII. WHAT MAKES THINGS GO

PURPOSE

Children are interested in things that go, and many of their destructive activities are due to a desire to find out what makes things go. The unit capitalizes this universal interest in order to help children to find out about the capacity to move or make things move, which is called energy. It also makes them more intelligent about and appreciative of some of the kinds of energy used in everyday life.

Probably the most popular "go" toy of all little boys is a train; so the theme of "What Makes Things Go" is illustrated by the various types of trains given to children at different stages in their development. All the various ways of making things go (except the real train) may be duplicated with toys in the classroom.

Jack's train experiences and the suggested activities will give children the opportunity to learn that

Some things move of themselves. They have the power to move.

Some things do not have power to move but must be moved by outside force.

SUGGESTIONS FOR THE TEACHER

The engine makes the train go
The engineer makes the engine go

Pages 106-107. Before reading page 107 there should be conversation about the picture. It will be readily seen that Tom is saying good-bye to his father, who is an engineer. This directs the attention to the engineer and to the important position he holds in relation to the train. The teacher must make sure that the children realize that the train cannot go until the engineer makes the engine go.

Some things are hard to move

The teacher should also encourage the children to talk about their own train experiences, and she should use this opportunity to bring out some facts about moving things. For example, a child may tell about seeing an engine pull a long, long train, and another may add that he saw a train with two engines pulling it. At this time the teacher should point out the fact that some things are hard to move. A long train is heavy, and heavy things are

hard to move. This is just one example of the many opportunities for learning that there may be in a good conversation.

After reading page 107 but before turning to the next page, the teacher should prepare for the succeeding pages by asking the children about the toy trains they have at home. The purpose is to find out if they are familiar with the various kinds of toy trains. She will probably find that they are eager to talk about electric and wind-up trains but that the push trains of younger days are forgotten. Ask questions such as "Does your baby like trains, too?" "What kind of train does he have?" This will help children to recall their own push trains.

This discussion of toy trains should bring out the fact that they are made to go in different ways. This should interest children in, and give more meaning to, the following pages.

Page 108. The suggestions for presenting the succeeding pages will not be given in detail, but the most important learnings to be developed will be pointed out. The teacher will of course, through her questioning, direct the discussion so that learning results.

Some things do not move by themselves
People make some things move

Tom's train experiences begin when he is one year old. Ask the children how they can tell that he is one year old. He has a push train. It illustrates the fact that some things do not move unless something moves them. This train moves because Tom moves it. He uses his energy or power to make it go.

Heavy things are hard to move

Experiment 1. Allow the children to move or try to move various things around the room. They will discover that it takes more energy or push to move some things than others. Some things may be too heavy to be moved at all.

Page 109. Tom is three years old. He is now older and stronger and has more energy and power to move things. He can make a bigger train go and go faster than he could at one year.

Wheels help in moving things
Friction makes things hard to move

There is another reason why Tom can make this big train move more easily and faster. Ask the children if they know why. Some

child will no doubt be able to answer correctly, "The wheels." But will the children know why the wheels make it go more easily and faster? The answer is that there is less friction. "Friction is the resistance encountered when one body slides past another." In other words, friction makes things hard to move. Wheels overcome friction.

Experiment 2. To give children an experience to show that more energy is needed to move heavy things, ask a child to try to move a heavy object, such as the teacher's desk. He will find it difficult to do, and he may not be able to move it at all. Ask another child to push with him.

Experiment 3. To give children an experience to prove that wheels overcome friction let them try to move a heavy box or piece of furniture by pushing it over the floor. It will be very difficult to move. In other words, much energy will be used for little movement. Then put some rollers (dowel sticks or old broomsticks) under the box and push again. The box will be easily moved with very little effort. Point out to children that the rollers are like wheels.

A spring makes things go

Pages 110-111. Tom is now five years old and he gets a train that is more realistic. It is one that seems to go by itself. The chief facts to be brought out through discussion are: The train does not go by itself. It too uses Tom's energy or power but uses it in a different way. This train has a spring. By the use of the spring Tom is able to store up energy until he wants to use it. Then he sits back and watches this stored-up energy make the train go.

Many children have used spring toys, but few of them understand what makes them go, because the spring is inside the toy and cannot be seen. The only way to understand is to see it work. So the teacher should arrange to give them experience of this kind.

Something else helps this train to go fast. The teacher should ask the children if they know what it is. The answer is, of course, the tracks. Ask the children, "How do the tracks help the train

to go fast?" If the children cannot answer this question, the teacher should recall the earlier discussion of friction. When things slide past each other, friction makes them go slower. The rougher the surface, the greater the friction. The floor is rougher than the tracks, so the train cannot go so fast on the floor as on the tracks, which are made of very smooth material.

A spring must be wound up

Experiment 4. Ask the children to bring to school old spring toys or get an old alarm clock from the clock-repair man. Take the spring out or take off the covering so the spring can be seen. Let the children experiment and find out how the spring works. They will discover that the spring will not work unless it is wound up by somebody. Even then it cannot go unless somebody lets go and it unwinds. As it unwinds it can make other things, such as wheels, go. After the spring unwinds it has no more energy, or power, to make things go.

The spring is a simple illustration of stored-up energy which is used little by little until it is all gone. Then it must be stored up again; or, in other words, the spring must be wound up again.

Experiment 5. Here is another simple experiment to illustrate the idea of stored-up energy:

Take a string with a button or other weight tied at one end. Hold the string in one hand, and with the other turn the button round and round until the string is twisted or wound up. Then let the button go and watch it revolve in the opposite direction. Notice especially how at first it goes very fast, then slower and slower until it stops. Children often do this kind of winding up on their swings and get a great thrill out of the unwinding.

Smooth surfaces reduce friction

Experiment 6. For a simple experiment in friction have the children push a finger over a piece of sandpaper and then over a piece of smooth paper or over a glass surface. They will discover that it is easier to push a finger over the smooth surface.

Electricity makes things go
Electricity can be turned on and off

Pages 112-113. At last Tom gets an electric train, which is the desire of every boy of eight. Electricity makes it go. Let the

children tell all they know about electricity, but be sure that they understand that electricity is energy. Electric energy is made in a power plant and comes to us over wires. It is used for many purposes, such as for lighting homes, for cooking, and for operating radios. When we want electricity to work for us we just turn it on. That is what Tom does when he wants the train to go. Tom turns on the electricity, and the electricity makes the train go. Tom does not have to do much work. When he wants the train to stop, Tom turns off the electricity. Then the train cannot go.

When talking to children about the use of electricity the teacher should caution them to use great care and to do no experimenting with electricity which comes over the house wires. If children show a keen interest in how electricity works or if they desire to light a doll house or install a bell in their own playhouse, the teacher should get the dry cells, electric wire, and other necessary equipment. In *Science for the Elementary-School Teacher*, pages 474-476, Dr. Craig gives excellent, detailed guidance for teachers.

Steam can be used to make things go

Pages 114-115. On his tenth birthday Tom has the best train experience of all. He gets a ride on a real engine. He turns the throttle and makes the train go. In other words, Tom turns on the power, or energy. Ask the children if anyone knows what power makes this train go. It is steam. The steam engine is a rather complicated machine for young children to understand, but the power of steam can be simply demonstrated.

Experiment 7. Boil some water in a saucepan which has a lid over the top. When the water boils, the steam will lift the lid up and down, making a clattering sound.

Experiment 8. A more dramatic illustration of the power of steam is to fill a test tube about half full of water. Put a cork in the top. Heat the water in the test tube over a flame until the water boils. When there is not enough room in the test tube for the steam, the cork will pop out. This proves that steam has power to move things. It is this power that is used in the steam engine.

Boiling water makes steam

If possible the teacher should take the children to the railroad station to see an engine. Be sure to call attention to the coal, which is used for heating the water. If the engine takes on water at your station be sure to see that activity. If this cannot be experienced show pictures of it or tell the children about it so that they will get the understanding that water heated to the boiling point makes steam and that steam has power.

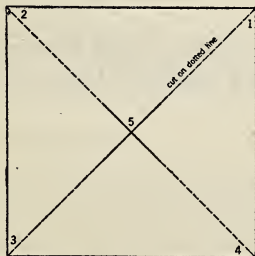
Page 116. In discussing with the children the pictures on this page the teacher's purpose should be to encourage children to look about them and see how things are being moved. She should also be alert to find out how extensively the children are able to apply the learnings of the previous pages to new situations. The automobile engine and the tractor engine, which are run by gasoline, and the buggy, which is moved by horse power, introduce new ways of making things go.

Wind makes things go

Page 117. This page introduces wind and water as ways of making things go. Children will find that experimenting with these sources of power gives interesting and valuable experiences.

Experiment 9. Make a pin wheel and watch the wind turn the wheel.

To make a pin wheel take a piece of paper about 6" \times 6". Fold the diagonals.



Cut on the diagonal folds to about 1 inch from the center of the paper.

Bring points 1, 2, 3, and 4 together so that they overlap at 5, thus making a wheel. Fasten the points together with paste or tape or insert a pin through the center of the wheel.

Now pin the wheel onto the end of a stick.

A good description of how to make and use a water wheel is given in *Science for the Elementary-School Teacher*, p. 435.

After a heavy rain the swiftly moving water in the gutter provides a good illustration of the power of moving water.

FURTHER ACTIVITIES

As each new idea of how things move has been developed, the teacher should encourage children to look about them to see other illustrations of the use of this same power and to tell about them. The bulletin board should be used at this time for the collection of pictures illustrating ways in which things are moved.

Have children go to the window, notice how many different ways of making things go they see, and tell about them.

MATERIALS

Experiments 1-2: no special material. *Experiment 3*: at least two dowel sticks or broomsticks. *Experiment 4*: old spring from a clock or toy. *Experiment 5*: a piece of string and a button. *Experiment 6*: sandpaper and piece of glass. *Experiment 7*: saucepan with lid, stove. *Experiment 8*: test tube, cork to fit (but not too tightly), stove. *Experiment 9*: paper 6" \times 6", pin, stick.

REFERENCE

CRAIG, GERALD S. *Science for the Elementary-School Teacher*, Chap. XIX. Ginn and Company, Boston, 1940.

VIII. AN EASY WAY

PURPOSE

Children today are living in a machine age. At every turn they see things being done as if by magic; and they, as well as many adults, have little conception of the mechanical or social principles involved. The purpose of "An Easy Way" is to give children some understanding of machines and their uses and also to awaken in them some awareness of the social effects of the use of machinery.

In their play lives children often struggle to do things which adults have learned to do in an easier way. Sometimes children when left to themselves discover better or easier ways, just as primitive man did. There is no reason, however, for their finding out everything for themselves when wise guidance will help their development.

The experiences of Jack and Susan and the suggested activities give opportunity for children to gain the following learnings:

A machine is something that helps us do work.

Most machines are complicated; that is, they combine a number of simple machines.

The understanding of the principles involved in simple machines helps us to understand complicated machines and to use them more intelligently.

The use of machines has important social implications.

Machines make work easier.

Machines do work more quickly.

The inclined plane is a simple machine. It is used by people to transfer things from one level to another.

SUGGESTIONS FOR THE TEACHER

Putting toys away is work

Pages 118-119. Every child will have had experiences which will help him to appreciate the situation described on these pages. They all like to take their toys out to play, but few of them like to put them away again. In the discussion of the picture the teacher should be sure to bring out this difference in attitude which makes the putting away work.

Two people do more work than one
Long ago people did work without machines

Page 120. Jack finds the work hard. All children will agree that it is hard to lift a heavy wagon up from one level to another. Ask, "What does Jack do to make the work easier?" Jack calls for help. He knows that two people can lift more than one person can lift. One way to make work easy is to get more people to do it. That is the way much work was done before machines were discovered.

Machines make work easy

Page 121. The picture shows that although Jack and Susan together can lift the wagon, it is still hard work. Ask such questions as, "What is Uncle Henry saying to the children?" "Why does he not help them?" The teacher at this point should ask the children what they would suggest to make the work easier. Possibly someone, without seeing the next picture, might mention a sloping board, which is an inclined plane. The most likely suggestion would be a pulley, which is another simple machine. Whatever their responses, the children's thinking about the problem is valuable.

The inclined plane is a machine

Page 122. Uncle Henry did help the children. Ask the children, "How did he help Jack and Susan?" The children will be able to see that Uncle Henry got a long board and placed it over the steps. Jack and Susan easily pushed their toys up the sloping board. However, the children will not know the principle involved here. The teacher must tell the children that Uncle Henry made use of a simple machine—a machine called an inclined plane. It is a machine which helps people transfer things from one level to another.

The teacher should encourage the children to talk about their own and other people's experiences with the inclined plane. A gangplank on a boat is an inclined plane. Stairs are inclined planes. A ladder is an inclined plane, and so is a ramp. These are but a few of the many familiar uses of this simple machine.

Machines do work more quickly

Page 123. The use of the inclined-plane machine made the work easy. It took less effort to get the heavy toys off the ground and

up into the building. It did not take two people to do it. The inclined plane also helped to get the work done more quickly. This fact is dramatically emphasized by mother's surprise when the children are ready for supper so early. The understanding of this fact has great social implications. When we use a machine and it does work quickly, we can get more work done or we can get the same amount of work done and have time for other things.

The teacher should further emphasize and illustrate this point by encouraging the children to talk about and bring pictures of machines in use in society.

Experiment. The teacher should give the children an opportunity to use an inclined plane. Fill an ordinary wooden box with blocks or books, making it too heavy to be lifted easily. Let the children try to lift it from one level to another. Then introduce the inclined plane (a long board) and let them experience how much less effort is needed.

Many workmen use the inclined plane

Page 124. The pictures on this page show various uses of the inclined plane. They are intended to promote discussion that will lead to a realization of the widespread use of this simple machine in everyday life. The teacher should encourage the children to look about them and report other uses of this machine.

A wheel helps to overcome friction

In "What Makes Things Go," page 109, the concept of friction and the use of the wheel in overcoming friction were introduced. The barrel and the wheelbarrow are further illustrations of ways of overcoming friction. The teacher should take advantage of this opportunity to find out if children are able to apply knowledge learned in one situation in solving a problem in a different situation. Ask such questions as "Is it easier to push a barrel or a box up an inclined plane? Why?" The answer is that the barrel is like a wheel. A wheel overcomes friction. It should then be noticed that the wheelbarrow is very easy to get up the inclined plane.

There are many kinds of machines
Some machines are complicated
Machines help us do our work

Page 125. The experiences with the inclined plane will without question stimulate a great interest in different kinds and uses of machines. The illustrations on page 125 serve to direct attention to a variety of machines used in homes, in the city, and in the country. These machines are complicated; they are combinations of more than one simple machine. The purpose is not to have children understand these machines but to emphasize the fact that machines are universally used to help us work. Encourage the children to talk about what makes these machines go. Here again is an opportunity for children to apply knowledge gained from former experiences ("What Makes Things Go"). Ask the children questions that will help them to understand that man furnishes the energy, or power, that operates the lawn mower, the carpet sweeper, and the food chopper. Some children may not recognize the hay rake or know that it is drawn by a pair of horses. Alert children who are familiar with sewing machines will see the cord that indicates that this machine is run by electricity. Probably every first-grade group will also have children who recognize the steam shovel. Refer again to pictures of the steam engine, pages 106-107 and page 115.

FURTHER ACTIVITIES

There are other simple machines
Simple machines are used every day

The alert teacher will find or make opportunities for children to become acquainted with the other simple machines, the pulley, the wedge, the lever, the wheel, and the axle and screw. These machines are being used all around us every day, but we are often unaware of it. Without a pulley, how could the flag be raised to the top of the pole so easily? Without the use of the screw, which is a spiral inclined plane, how could we so easily change the height of a piano stool? Without the use of a lever, how could we open cans so easily? These are but a few of the many uses of simple machines.

Encourage the children to tell about different machines they

see being used on the way to school. Make a list of the machines and the work they do for us. Use the bulletin board for pictures of machines. Have an exhibit of machines brought by children.

MATERIALS

Material needed for the experiment on page 83 of the Manual: wooden box, about 18" \times 12" \times 10"; board, 10" wide \times 4' long; blocks or books.

Some suggested materials for experimentation with simple machines: rope, clothesline, pulleys of various sizes from the ten-cent store, old broomsticks, an old automobile jack, old cartwheels.

REFERENCE

CRAIG, GERALD S. *Science for the Elementary-School Teacher*, pp. 414-438. Ginn and Company, Boston, 1940.

Dr. Craig gives a simple but clear and comprehensive description of simple machines and suggests ways in which they can be used in the classroom.

IX. WATER

PURPOSE

One of the most familiar things in a child's environment and one of the most important is water. Every child uses water each day in at least two ways, for drinking and washing. Things that are so familiar we take very much for granted and often do not realize the great effect they have on our lives.

The purpose of this unit is to give children a larger concept of the nature of water and its effect on life. Through the reading and discussion of the activities of Jack and Susan and participation in other suggested activities children will have an opportunity to learn that

Water is essential to life.

Rain is water. Rain is very important because we are dependent upon it for a great part of our supply of ground and surface water.

Water has many uses.

Water exists in three states: liquid, gas, and solid.

No Rain (Pages 126-129)

SUGGESTIONS FOR THE TEACHER

We cannot order the weather

Pages 126-127. In the discussion of this picture the teacher should lead the children to realize that Susan and Jack are not thinking of the far-reaching effects of rain or no rain. They have personal reasons for wanting rain, to use the red umbrella and red boots. Ask such questions as, "Is this a good reason?" "Who can think of a better reason for wanting rain?" The answer to the latter question should and probably will anticipate many of the experiences that come later.

The most important learning to be gained from a study of this page is the fact that wanting rain does not bring rain. We cannot order the weather.

No rain makes dust

Page 128. The discussion of this page centers around what happens when there is no rain. Ask, "What work is Mother

doing?" "Why does she have to dust so often?" The ground is dry because there has been no rain, and the wind blows the dry ground into the air. We say it is very dusty. Reference may be made to duststorms in parts of the earth where there is little rainfall.

Plants need water
Animals need water

Father has extra work to do, too, because the ground is dry. The grass and the plants in the garden will die unless they have water. So Father has to sprinkle every day. Children should be reminded of the fact that animals need water. During dry spells the children must make sure that their pets have plenty of water, and they should put a pan of water out for the birds.

Some clouds are rain clouds

The statement that there were no clouds directs attention to clouds, and children learn that some kinds of clouds are rain clouds. Since a rain cloud appears on page 130 the teacher will probably postpone a more detailed discussion of the clouds and the cause of rain until that page is read.

A weather chart is a way of recording the weather

Page 129. Children can get some idea of how unusual this is by looking at their own weather calendar. In many classrooms a record of weather is kept on a large calendar, either commercial or self-made. At a designated time each day the weather is indicated. A picture of an umbrella indicates that it is raining. A picture of a sun indicates sunshine. Cloudy days are indicated by gray paper. If there is a weather calendar which may be consulted, it will probably show that under usual conditions there is rain every few days.

Rains are needed when the water in lakes and rivers is low

The teacher should call attention to a serious and far-reaching effect of lack of rain which is indicated by Father's saying, "There is not much water in the lake." Lakes and all surface streams are replenished by rains. After heavy rains children have seen water rushing down the gutters and down the hills as it finds its way into brooks or rivers and lakes. Some explanation of the fact that our water supply comes from lakes or rivers or wells must

be made. Children in whose homes the water supply comes from wells will probably have had experiences with a shortage of water.

Conservation of water is essential
Frequent bathing is necessary for health

The idea of conservation is brought in by Father when he says, "We must not use much water." Jack's remark indicates that he interprets this to mean that some of our activities will be banned, and he proposes to do without a bath. This should stimulate some discussion as to the need for bathing to maintain good health. But Father has a different idea of conservation. He considers frequent and regular bathing essential to good health. He thinks that if everybody uses proper care, that is, does not waste water, there will be enough for everybody and for all our needs. This idea of conservation applies to all materials all of the time and not just in emergencies. Conservation should be one of the values emphasized in teaching children.

Rain (Pages 130-136)

SUGGESTIONS FOR THE TEACHER

There are many kinds of clouds

Page 130. This is the time to direct the attention to a discussion of clouds. Let children tell about the different kinds of clouds they have seen, some white, some gray, and some very dark. They probably already know that the very dark ones are rain clouds.

Children have a very vague idea of what clouds really are, and it is not necessary at this time to go more deeply into the subject. However, it is important for the teacher to know in case this aspect of rain comes up for discussion.

What are clouds?
What is rain?

Clouds are formed when air which contains a certain amount of water vapor (water in the form of invisible gas) is cooled and the water vapor changes into tiny droplets. If the droplets get large and heavy they fall to the earth as rain. For further information about clouds see *Science for the Elementary-School Teacher*, pp. 218-220.

The children will probably attach great importance to the fact that Jack and Susan do not have their umbrella and boots. This

will give the teacher an opportunity to weigh their personal reasons for wanting rain against the real need for rain which has been discussed. Ask, "Do you think Jack and Susan want rain now just to use their boots and umbrella?"

Rain is water
Water makes things wet
Colds sometimes come from wearing wet clothing

Page 131. This page will probably stimulate much conversation, because it depicts an experience most children have had. Because of these experiences, there will be no teaching necessary for children to realize that rain is water and water makes things wet. The teacher should direct their attention to the advice of the mother. People use umbrellas and wear raincoats and rubbers to keep their clothing dry. People sometimes take cold from wearing wet clothing. This fact should be emphasized, because children seem to like to get wet and especially to get their feet wet. If they are caught in the rain they should have their clothing dried. Schools are often the greatest violators of this good-health rule and allow children to sit all day in wet clothing.

Wet floors are slippery

Page 132. The discussion here should be concerned primarily with proper clothing for rain. Children properly dressed for the rain do not get their clothing wet. Another health or safety rule is emphasized; that is, wet floors are slippery, and we should avoid walking on them until they are mopped up. Children can learn to take responsibility for wiping the wet floor.

Water soaks into the ground

Page 133. The discussion of this page should be directed toward learning about the effect of rain on the ground. Ask, "What becomes of the rain when it falls to the ground?" The answer to this question should bring out some of these learnings:

When rain falls to the ground, some of it runs down the gutters and hills to the rivers or lakes.

Some rain soaks into the ground. This makes the ground soft. When the ground cannot take any more water, it stays on top of the ground and makes big and little puddles.

In discussing the last of these learnings some child may ask, "Why doesn't the water in the puddle run off into the gutters?" It can't, because the ground around the edge of the puddle is higher than the water. The water can't get out.

"This is good weather for ducks!" is a popular saying often used in referring to the weather or a rainy day, because ducks like water.

Rain affects mothers' and fathers' work

Page 134. This page illustrates again the effects of weather on our daily lives. Almost every kind of weather has both disadvantages and advantages. The children should be encouraged to give more illustrations from their own home experiences.

Earthworms sometimes come out of the ground after a rain

Page 135. Finding earthworms on the sidewalk is a usual experience in many places after days of rain. Most children believe that the worms come down with the rain, and the purpose here is to correct this misunderstanding.

The teacher should also direct the children's attention to the effect of rain on pets. Let the children tell about their pets. Then ask, "Are there some animals that do not like water?" "What do they do when it rains?" "What do farm animals do when it rains?"

Rain interferes with play

Page 136. Mothers' and fathers' activities are not the only ones curtailed or affected by the rain. The children wanted rain, but too much of any one kind of weather is not good. It again emphasizes the fact that we cannot order the weather.

After the Rain (Pages 137-143)

SUGGESTIONS FOR THE TEACHER

Sometimes clouds hide the sun
The sun shines always

Page 137. Here is opportunity to learn more about clouds. When they get between us and the sun we cannot see the sun. When the rain clouds move away the rain stops and we see the sun. Be sure to talk about the fact that the sun was shining when it rained but we could not see it. In fact the sun shines all the time.

The rain cleans things

The teacher should stimulate the children to recall the picture, on page 128, which showed a part of the garden in the days when there was no rain. The air was full of dust, some of which settled on the leaves and grass. Too much dust on the leaves of plants keeps them from proper functioning. It was good for the plants to be washed by the rain.

Some things float
Some things sink

Page 138. The purpose here is to find out more about water. The best learning comes from real experiences in finding out which things float and which sink. Children should be given an opportunity to experiment. It is obvious, of course, that playing in a puddle is not the only method. Many discoveries may be made with a small pan of water.

Experiment. Provide a large pan filled with water. Let the children put things into the water. Try such things as a flat piece of wood, a piece of iron, a bottle, a cork, a feather, a tin cover, a flat piece of paper, and a piece of paper made into a ball.

Water moves
Water moves other things

Page 139. This page will recall the fact, introduced on page 87, that water moves. When it moves it can move other things.

Rubber boots keep feet dry

The fact that Jack went into the water and his feet did not get wet might come in for some discussion. Rubber is a material that resists water; in other words, it keeps water out. Water cannot go through rubber. The children should observe that the boys and girls in the picture are wearing their rubbers.

Water and soil make mud
Mud sticks
Cleanliness is necessary for good health

Page 140. Why did Miss Hill say, "Wipe your rubbers before you come in?" This question should bring forth discussion about mud. Ask, "What is mud?" Water mixed with soil is mud. Mud sticks to things. A good health rule, cleanliness, is also emphasized here.

Page 141. Evaporation is the important learning on this page. The text itself asks the leading question "Where did it go?" The children should be given an opportunity to answer in their own way before they continue with the reading of the page. The teacher should be sure that the information given by them is correct.

Water evaporates

Page 142. This page introduces the word *evaporates*, which the children may or may not have known but which they should now use with meaning.

There is water in the air

Page 143. There is something very stimulating to children about evaporation. The fact that they cannot see it take place makes it rather mysterious. For this reason experiments are almost a necessity. The "things to do with water" are three experiments which will give children the answers to many of their questions. Following are the results which should be obtained:

1. The water evaporates.
2. The water in the shallow dish evaporates most quickly because there is more water exposed in the air. The water in the bottle evaporates most slowly.
3. The water in the warm place evaporates more quickly because the air around it is warm. Warm air can hold more moisture than cold air.

FURTHER ACTIVITIES

Water exists in three states—solid, liquid, gas

Experiments with evaporation may be further guided so that children may learn that water exists in three states—liquid, solid, and gas. (See *Science for the Elementary-School Teacher*, pp. 212, 218.)

Because they cannot see it, children are often not satisfied with the statement that water is in the air. At this point they are ready for the experience of changing water from one form to another. When evaporation takes place, water is changed from a liquid to a gaseous state. When it is in the gaseous state, it cannot be seen. An experiment to prove that there is water in the air

will also be an experience in changing water from the gaseous state to a liquid.

Water comes out of the air

Experiment 1. In order to demonstrate that water comes out of the air, fill an ordinary drinking glass with colored ice water. Moisture soon forms on the outside of the glass. That moisture came from the air. Cool air can hold less moisture than warm air. The air next to the glass was cooled and the moisture remained on the glass. This process is called condensation and is just the opposite of evaporation.

Experiment 2. Children should also experiment with changing water from a liquid to a solid state. On a cold winter day they may put a pan of water out of doors to freeze. In summer they should put water in the refrigerator.

MATERIALS

For the experiments on page 143 of *Science All About Us*: (1) a flat pan; (2) three containers with different openings—a bottle, a bowl, and a shallow dish; a measuring cup or glass; (3) two pans (or bowls) just alike.

For the additional experiments described in this Manual: *Experiment on page 91*: large pan, pieces of wood, iron, cork, feather, paper, and other objects, some of which will float and some of which will not float. *Experiment 1, page 93*: a drinking glass, red ink or a small piece of crêpe paper to color water, ice cubes. *Experiment 2, page 93*: a small pan.

REFERENCE

CRAIG, GERALD S. *Science for the Elementary-School Teacher*, pp. 212-226, 260-262. Ginn and Company, Boston, 1940.

X. HOMES

PURPOSE

A walk in the woods with children for the purpose of finding animals is often a disappointing experience, but looking for animal homes is sure to be successful and very interesting. There is much that we can learn about an animal from a study of its home.

Through the study of these pages and the discussion which will be stimulated by the pictures and the text, the children will have an opportunity to learn that

Animals build many kinds of homes.

Animals build homes in many different places.

Animals make homes that suit their needs.

One of the chief purposes of a home is to provide a place for the rearing of the young.

A Woodchuck Home (Pages 144-147)

SUGGESTIONS FOR THE TEACHER

Animals build homes in many different places

Page 145. Before reading this page the teacher should encourage the children to talk about their own walks in the woods. She may ask such questions as "Did you see any animals?" "Why not?" "Were there any animals living in the woods?" "How do you know?" "Did you see an animal home?" "Where was it?" These are suggested questions that will interest children in animal homes and probably bring out many of the ideas to be developed later.

In talking about animal homes one of the facts to be noted is that animals build in many different places. In the case of the woodchuck the home is in the ground, but that is not the only place to look for animal homes.

A woodchuck's home has more than one door

Page 146. Some of the ideas to be developed here are: One of the most interesting things about a woodchuck's home is that it has many doors. This shows that an animal makes the kind of home he needs. A woodchuck cannot run very fast, but by having more than one door to his home he has more chances to escape from his enemies. The dog is one of his enemies. When the

woodchuck gets inside the door he is safe, for the hole is too small for a dog to get in.

Animals make the kind of home they need

Page 147. In order to develop the idea that an animal makes the kind of home it needs, it is necessary to know what takes place in the home. Let the children tell all they know. The teacher should correct any misinformation. Most animals make their homes where it is difficult or impossible to see what takes place. This is true of the woodchuck. We know, however, that the babies are born there and taken care of until they are old enough to care for themselves.

Like other baby mammals, baby woodchucks are fed milk from the mother's body. Many children have observed mother and baby white mice or guinea pigs, and they know about mother care. If the teacher discovers that children have not had this experience, she should arrange for such an experience, for the rearing of the young is an important function of the home. Reference and comparison should always be made to the care of human babies.

Young animals meet danger in different ways

How the different animals meet danger is an interesting topic for consideration. It is often closely related to the kind of home they build for themselves. With so many doors it is quite easy for woodchuck babies to get inside their homes when danger is near.

The teacher should also help children to recall previous conversations about hibernation. The woodchuck sleeps all winter in his home underground and wakes up again when spring comes. The woodchuck's home seems to meet his needs.

A Rabbit Home (Pages 148-150)

SUGGESTIONS FOR THE TEACHER

Some animals build homes on the ground

Page 148. "A Rabbit Home" is introduced to illustrate the fact that animals make their homes in different places. Some rabbits build homes on the ground. The question, "Is this a good home for a rabbit?" will give children an opportunity to do some good thinking.

Some homes are not very safe

Page 149. The evaluation of the rabbit home will show that it does not seem as safe for babies as the woodchuck home. Ask the children, "How does the mother protect her babies?" The answer is given in the text. Putting leaves and grass on the nest introduces the idea of protective coloring, or camouflage, as a safety measure.

Some baby animals grow up fast
Animals meet danger in different ways

Page 150. The emphasis here should be put on the idea that the rabbit home serves its needs. This idea should be developed through conversation guided to bring out some of the following ideas: Like baby woodchucks, baby rabbits are fed and cared for by the mother. The facts that baby rabbits grow up very fast (within two or three weeks) and can soon take care of themselves help to explain why their home on the ground serves their needs. Ask the children, "How do baby rabbits meet danger?" They do not run to their homes because their homes are not built for protection from enemies. Instead they sit very, very still. Ask, "Why is it hard to see them when they sit very still?" Movement attracts attention; so if the rabbits are still they sometimes are not seen. But when they know that their enemy has seen them, they run; and because they can run so very fast, they can often escape from their enemies. They do not need a safe home to go to because they can run so fast.

A Squirrel Home (Pages 151-153)

SUGGESTIONS FOR THE TEACHER

Some animals make homes in trees

Page 151. The fact that animals make homes in different places should again be emphasized. The question "Is this a good home for a squirrel?" will give the children an opportunity to apply their ideas about what constitutes a good home.

Home is a place for caring for the young

Page 152. Again the home as a place for the care of the young is important. As a matter of fact, that is the only purpose of the squirrel's nest because during the winter the squirrels live in hollow trees.

The growing-up time of children is longer than that of animals

Page 153. Two or three times reference has been made to the fact that these animal babies grow up very fast. This will mean much more to children if they compare the growing-up time of animals (or the time it takes for animals to take care of themselves) with the growing-up time of children.

After such a discussion ask the children if the growing-up time has anything to do with the kind of home an animal needs? Because animals grow up so soon they do not need such permanent homes as people do.

When baby animals grow up they make their own homes

The idea of young animals leaving the home when they have grown up should be compared to what happens in human homes when children grow up.

Other Homes (Pages 154-157)

SUGGESTIONS FOR THE TEACHER

Animals make many kinds of homes

Animals make their homes in many different places

Pages 154-155. These pages suggest a variety of animals, a variety of homes, and a variety of places to look for them. It is hoped that the text and pictures will stimulate children to look for homes whenever they have an opportunity. They should be encouraged to tell about the homes they have seen. The pictures show a wild duck's home on the ground, a snake's home under a rock, a beaver's lodge on a lake or pond, and an anthill.

Page 156. Before reading this page let the children talk about Susan and Jack's home and discuss the things it does for them. Bring to their attention the fact that it provides protection from wind and rain and cold and heat. Ask them, "How did the animals' homes compare with this one in these respects?" "Did the animals need as much protection from the weather?" "Why not?" They are better protected by their own coverings.

What is a good home?

Page 157. It is interesting and worth while for children to compare the relative values of the various homes. Father sums up the most important characteristic of a good home when he

says, "This home is a good one for us." He conveys the idea that what constitutes a good home depends upon the nature and needs of those who live in it.

FURTHER ACTIVITIES

Take children out of doors to look for animal homes. Discover if possible why each home is a good one for the animal that lives in it.

Collect pictures of animal homes for the bulletin board. Arrange them according to location of the home, such as

Homes in the ground
Homes on the ground
Homes in water
Homes in trees, and so on

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Films

The following list includes films that may be used in connection with certain units of *Science All About Us*.

THE SEASONS

Play in the Snow

ANIMALS

Three Little Kittens
 Snapping Turtle
 Gray Squirrel

Bunny Rabbit
 Elephants
 Frog
 Care of Pets

Robin Redbreast
 Black Bear Twins
 Animals of the Zoo

PLANTS

Gardening

WHAT MAKES THINGS GO

Passenger Train

Bus Driver

Boats

Airplane Trip

HOMES

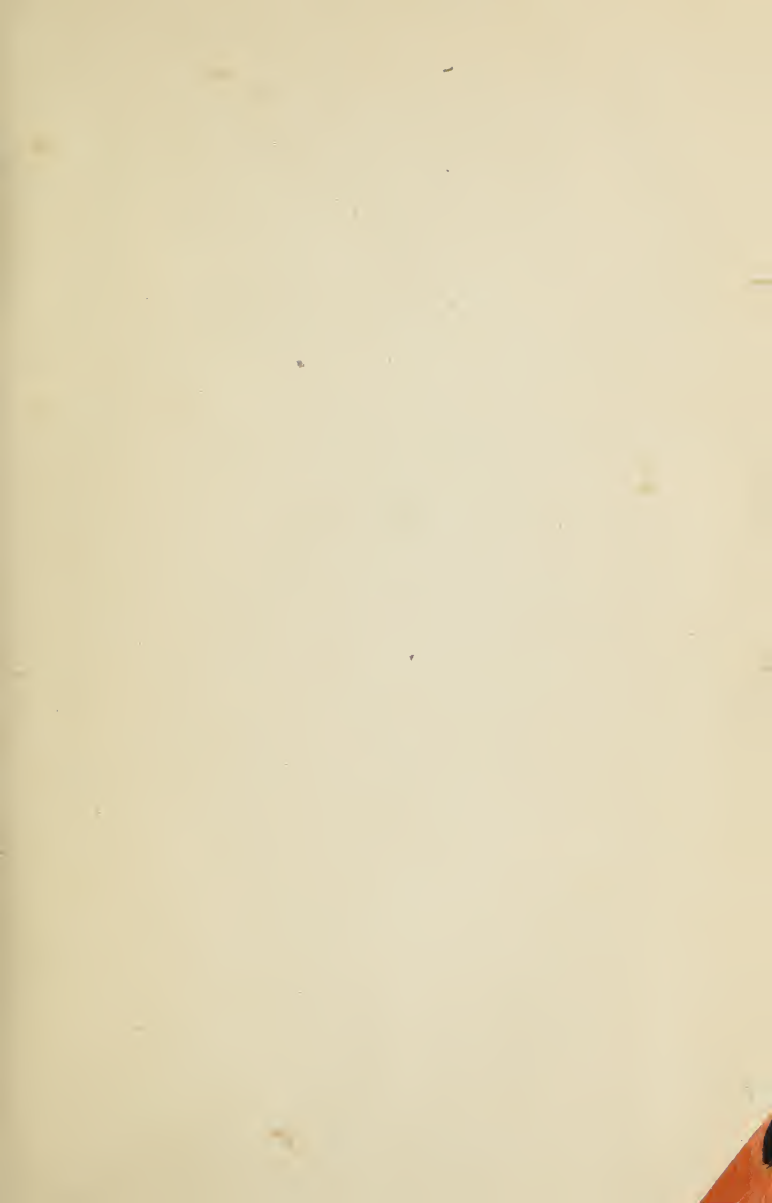
Common Animals of the Woods

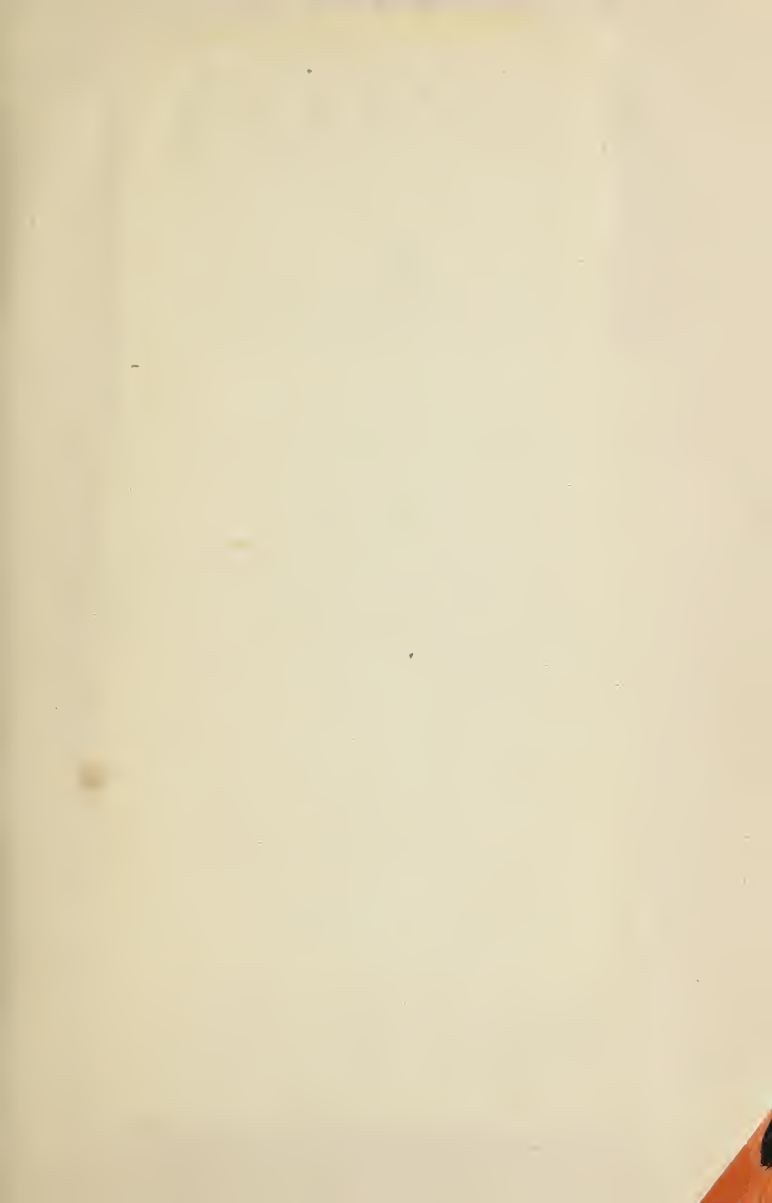
Gray Squirrel

Robin Redbreast

The films mentioned above are produced and distributed by Encyclopædia Britannica Films, Inc., 20 N. Wacker Drive, Chicago, Illinois. Many other educational films are available, produced and distributed for sale or rental by a number of agencies. These films are listed and classified, with brief descriptions, in a monthly cumulative catalogue, *Educational Film Guide*, compiled by Dorothy E. Cook and Eva Rahbek-Smith, and published by The H. W. Wilson Company, 950-972 University Avenue, New York 52, New York.

There is of course a considerable range in the effectiveness of films, and no film should be used in the classroom on the basis of title or brief description only. The teacher should become familiar with the content of the film and its suitability for classroom instruction before it is secured. In the case of films produced to illustrate industrial products or processes, one should scrutinize them for any possibly objectionable advertising.





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